World Food Problems

Silage and Silage Machinery

WORLD CROPS

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The International Journal of Agriculture

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Oil Palm, valuable crop of the tropics, supplies one tenth of the world's output in vegetable oils and fats. *For further details see page* 410

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Green grow the olives

Perhaps an outward-bound Roman legionnaire or a home-going proconsul once plucked an olive as he passed through Apulia, along the famous Appian Way. For this ancient province (forming the 'heel' of Italy) was, and still is, noted for its excellent olives. Its people, whose forbears have known Roman, Greek, Saracen, Norman and Spanish overlords, today strive to overthrow yet another 'foreigner' on their soil . . . *Rhynchites cribripennis*, the olive weevil. This time they have an effective weapon. It is dieldrin, and it is proving highly successful. The trees and the surrounding soil are given two sprayings when the young fruits first appear. These prevent the female weevil burrowing into the olives and laying her eggs within. Thus, the year's harvest gets off to a sturdy start.

Nor does dieldrin's good work finish there. The two sprayings of this persistent Shell insecticide usually control the first and second generations of the olive fly as well. Other pests, such as the olive thrips and the olive moth, are also held in check by the treatment. Between them, aldrin, dieldrin, endrin, Phosdrin, D-D and Nemagon can control virtually every major world pest. **dieldrin**

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1960

Editorial Comment

Grass as a Crop

This is a good pasture. If you plough it up you will make it a better one.

SIR GEORGE STAPLEDON (1883-1960).

IN BRITAIN the change in outlook towards grass since 1930 has been revolutionary. Formerly grass was grown as a permanent pasture with little thought or attention. Today grass is treated as a crop and it receives just as much attention as any other crop. As a result, it is true to say that 'two blades of grass are now grown where only one grew before'.

This remarkable change is the direct result of the application of the techniques which the late Sir George Stapledon* evolved and advocated. The impact of his work on grasslands thinking has been world wide and the transformation of neglected and marginal lands is proceeding apace.

This reclamation of derelict land through ploughing up and reseeding, and his ideas of ley farming whereby grass was included in the rotation, was the basis of his philosophy of grassland improvement and it was largely through his influence that other research workers have been stimulated to breeding new varieties of grasses and clovers.

Many recent developments in such countries as Australia and New Zealand are really based on the ideas which Stapledon first conceived. In New Zealand strains of ryegrass and clover have reformed the dairy and sheep pastures. In Australia, deserts are being reclaimed with enormous increases in land values.

Tropical Grasslands

The man who allows himself to develop into a high-brow will not be a good agricultural scientist and he will be a poor farmer and a boring fellow.

SIR GEORGE STAPLEDON

The importance of better management of tropical grassland, using the latest techniques, was emphasised by the Duke of Edinburgh when, as President, he opened the 8th International Grassland Conference at Reading. He pointed out that the greatest progress had been made in parts of the world that enjoyed a temperate climate, but he considered that the greatest potential for development lay in the improvement of tropical and sub-tropical pastures.

The real difficulty has been the inadequate application of the results of research. He considered that no scientific organisation was doing its job properly unless it took an active interest in the application of its findings. It was too tempting to turn out results and leave it to someone else to do something about them.

Grass—The Cheapest Feed

Good grass, in its natural state, is the cheapest food for cattle, but it is not always available and its renewal may be hampered by trampling and soiling and by adverse climatic conditions.

Efficiently conserved, either as hay or silage, grass can carry the quite heavy overhead costs involved in the use of modern harvesting machines and still hold its own against bought concentrates—cake or coarse grains. But it needs to be cut at the right stage (just before flowering) and properly dried or ensiled.

Every year, as techniques improve and become more labour-saving, it becomes harder, with each step forward, for the small farmer to decide what to do for the best, as Mr. Harold Woolley said at the 2nd Grassland Demonstration at Reading, this year.

Silage or Hay?

The circumstances of each farm must therefore determine the choice, for if the grass is cut at the same time and the hay or silage is well made, both will have the same feeding value. The object in all cases is the same—to satisfy the needs of the herd when fresh green feed is scarce or not available.

The cheapest method of conservation is obviously to sun-dry the cut grass and accelerate the process by crimping and using a mechanical tedder. In practice, mechanical haymaking is fraught with difficulties and where the climate is uncertain, severe losses may be incurred if the weather changes suddenly.

In those countries where the climate is uncertain or the rainfall can be heavy and prolonged, it looks as though it is a wise policy to cut and crimp the grass, obtain the wilted baled crop and dry it in bales, using either electricity or oil. All that is required is two consecutive fine days to get the air-dried wilted crops under cover as soon as possible.

The generally accepted answer today is to make silage—a process which is virtually independent of the weather. Soil contamination, in normal conditions, is low and crop recovery is high, and a succession of crops may be cut when the crop is in its most nutritious and palatable condition.

We now have all the tools to do the job properly—self-unloading trailers, mobile blowers to carry the crop into the silo and chopping attachments that will cut the material as short as grass for self-feeding to the cattle, so cutting the labour requirements to a minimum.

* Sir George Stapledon died on 16 February, 1960; he was the first Director of the Welsh Plant Breeding Station (1919) and subsequently (1940) he became Director of the Grassland Improvement Station, Stratford-on-Avon.

Hypomagnesaemia

THIS LONG word is the name of a disease of animals otherwise called grass tetany, lactation tetany and grass staggers, which can appear without warning and at any time of the year, but there are especially dangerous periods.

This physiological disorder, which is characterised by a low content of magnesium in the blood, is much more common in animals grazing on leys than permanent pastures, and more important for dairy herds early in the grazing season with the first flush of grass.

Intravenous injections of magnesium salt, if given in time, can effect spectacular cures. The Ministry of Agriculture of Britain in Animal Health Leaflet No. 49* states that if the pastures have not been top-dressed in accordance with the recommendations given in this leaflet it may be advisable to feed the animals with magnesium-fortified concentrates.

Oil and Agriculture

THE CONSEQUENCE of the growing dependence on oil as a major source of energy is that any check to the rate of investment in the oil industry would necessarily interfere with the maintenance of the overall rate of agricultural development and food production. It follows from this that farmers the world over have a common interest in the reasonable prosperity of the industry and in the avoidance of price levels so low as to be uneconomic.

If, as a result of denying the oil companies a fair profit, the flow of funds for reinvestment and exploration were to be impeded, the illusory nature of the benefit of unduly low prices to the farmer would soon become apparent. It is also of the highest importance to those countries whose present prosperity and rapid development in the past 50 years has been the fruit of the profitable sale of oil to the consumer.

Oil in the desert is no more useful than is sand unless it can be conveyed to the world's markets through pipelines, tankers and the whole network of the industry. There is no magical solution to this problem. It requires initiative, business enterprise and money in large sums with the prospect of a fair profit.

The consequences of any major disruption in this process of profitability cannot but bring in its train a cutting back of investment and, ultimately, a break in the economic flow of oil to the areas of consumption, and so also in the flow of development funds to the under-developed territories.

The search for oil has never been so intensive, and daily more and more reserves are being uncovered. The world cannot afford to leave untapped any source of energy in view of the ever-increasing demands from the nations of the world. So far the oil industry has been outstandingly successful in playing its part in the supply of cheap energy.

It would be regrettable if, for any temporary political or economic advantage from any quarter, this truly creditable effort were to be frustrated by artificial, unnecessary and self-defeating measures, which would actually have the effect of restricting the advancement of agriculture in the under-developed and backward areas of the world.

Controversial Issue

WITH TRACTORS fast replacing draught animals, manufacturers are vying with one another to show off their latest mechanical offspring and demonstrate how easy it is to produce the perfect furrow with their tractors and implements.

Indeed, the straightest furrow, coupled with the correct turnover of the soil and the smartest turn-about at the headlands within the allotted time limit, obtains the premier award in ploughing competitions. In this issue the 1959 Champion Ploughman of the World—W. L. McMillan—claims that such competitions serve a useful purpose in setting and maintaining ploughing standards.

Long-established practice is not necessarily the best, and we question whether it is always good practice to plough straight up and down hill, or diagonally across a slope, examples of which can so often be seen, even on highly erodable soils. We submit that the man who can plough exactly parallel furrows closely following an unstaked contour is a better ploughman than one who ploughs straight and true.

It is often said that soil erosion in Britain is not appreciable, but over the years the effect is cumulative. On the few occasions when torrential storms occur erosion can be just as serious as in tropical countries, particularly in the case of the more open-textured soils with up-and-down ploughing.

Research in Ireland

WE ALWAYS welcome news from Ireland and were particularly glad to receive a copy of a new and attractive illustrated publication entitled 'Farm Research News'.

'An up-to-date programme for developing Irish agriculture', the editor says, 'must, to achieve the best results, maintain a balanced advance on all fronts, matching production to markets, domestic against foreign requirements, and so on. Rapid and continuous growth of knowledge of all aspects of agriculture is now normal, and this demands continuous adjustment in every field of practical farming. Here science plays an indispensable role, for it is only through unceasing and detailed study that the evidence required to make these adjustments can be obtained.

'It is not sufficient to base decisions only on con-

* Obtainable from H.M.S.O., price 2d.

ditions in the field under immediate study. Every adjustment has repercussions on what is happening in other fields, and a research programme must be planned to cover simultaneously every problem in the complex.

'This applies in all countries where financial resources are limited. It is not possible to give all the numerous questions, which could profitably be studied, the benefit of full-scale research. Some must be given priority, and some omitted or deferred'.

The most careful thought must be given to determining these priorities, and the relative amounts of resources to be applied to each, as well as to planning and carrying out the subsequent study in such a way that the maximum information is obtained from each project. Undue concentration on any one facet could not only waste resources of land, labour and money, but might lead to undue emphasis being placed on relatively less important fields of development.

To plan and carry through any such scheme successfully teamwork is a vital consideration. First of all, in drawing up the programme, the talents of experts in a great many fields must be brought together. These experts must also co-operate at the next stage to extract from the various experiments the lessons appropriate to their various fields of study. When the results are available and in use, there must be co-operation on a much wider basis between the research workers, the extension officers, the farmers and those concerned with the production, transport and marketing of the products.

It is only through such a systematic, unified and planned approach that the wasteful speculation which has caused the failure of so many promising developments, such as the East African Groundnut Scheme and the short-term food production scheme in Malaya in the immediately post-war years, can be avoided and the maximum value obtained with the limited resources available.

Three Centuries of Science

NEVER HAS the Royal Albert Hall in London provided a more appropriate setting for an academic festival, if only because the occasion that Brahms's music was embellishing was perhaps the greatest academic festival of the century—the tercentenary of the Royal Society. The arena of the Albert Hall was filled with a vast crowd assembled to witness the ushering in by the Queen of the fourth century of Britain's national academy of science.

The Queen recalled the founding of the Society under the patronage of Charles II and referred to some of the great Fellows—Newton, Darwin, Watt, Kelvin and Parsons. The Society ordered its affairs today in much the same way as it always had, said the Queen, but an innovation that gave her special pleasure was the admission of women to the Fellowship. After welcoming the foreign visitors she presented the Society with a silver bell to mark her continued interest as patron and to ring in the fourth century of the Society's history.

Sir Cyril Hinshelwood, the President, thanked the Queen and then Sir Arthur Bliss, Master of the Queen's Musick, conducted his work, 'Salute to the Royal Society on the occasion of its Tercentenary'.

The pageantry continued with three representative addresses of congratulation given by Professor Graffi representing the University of Bologna, Professor Lecomte representing the Academy of Sciences of France, and Sir John Eccles, President of the Australian Academy of Science.

After the President had expressed his thanks for what he called 'these precious manifestations of goodwill', he formally introduced King Gustav Adolf VI of Sweden for admission to the Fellowship. The King signed the charter book and then, in flawless English, addressed the assembly. He referred to Linnaeus, his own compatriot, who was a Fellow, and then to the many Fellows, including the President, who had received Nobel prizes. The Royal Society, he said, had served as a model for most other national academies of science, not least the Royal Swedish Academy, founded in the 18th century.

For 40 minutes the President presented what he called an account of the Society's stewardship before the world. In achievement the 300 years of its existence had exceeded all the infinite wastes of evolutionary time; 'by the scale of human events they are the fullest and longest in existence'.

'Tried checking the hydraulic cone clutch actuation, boss?'

The men who founded the Society were still fresh in mind and their dedication to the uncovering of the secrets of nature had established a living tradition. Much was said of the sympathy with which the Society's establishment was received, but the founders met fierce criticism and even in 1700 the corporate income of the Society was no more than £100. But the original Fellows lived up to the Society's motto, *Nullius in Verba*, accepted none of the authority of dogma and remained unmoved by praise or blame.

The President ended his broad and beautifully composed survey with a look at the future. The task of scientists was clear: it was to go ahead undeterred by uncertainties. 'Not exemption from danger, hostility or temptation, but the power to sustain their impact has made men what they are. The great weapons have been the things of the mind, and among the greatest of these is knowledge.

'It is the duty of the Royal Society not to predict, not to legislate, but to maintain within the larger community the smaller one in which creative activity can flourish'.

This Month's Cover Picture

1.2 million m. tons of palm oil and 1.1 million m. tons of palm kernels, representing a value of about U.S. $368 million, have been produced in 1958, supplying 1.6 million m. tons of the world's 15 million m. ton production of vegetable oils and fats.

For a number of West African and South-East Asian countries, oil palm products form the backbone of agricultural exports. The maintenance and improvement of productivity of the oil palm plantations contribute both to the planters' as well as to the country's benefit, and research workers in these countries are always anxious to gain more information about the most profitable cultivation of this valuable crop.

The results so far obtained indicate the outstanding value of adequate and correct applications of fertilisers. Potash in particular gives more resistance against attacks by insects and diseases, hastens the appearance of new leaves and increases the weight per bunch—in short, an overall increase in productivity. Potash fertilisers are supplied by:

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Post Box 524,
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Jamshedji Tata Road,
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'The Grass is Greener'

ON SIMMS MOTOR UNITS LTD. Stand at the Royal Show at Cambridge was a new idea which we all noticed but no one realised.

Whilst all the surrounding grass was parched and shrivelled, that on the Simms Stand was refreshingly green, for it appears that on the eve of the opening of the show all the grass on the Stand was spray-painted with a green emulsion which was impervious to subsequent rain and kept the whole place looking like a oasis in the surrounding desert of parched turf.

The green background was particularly flattering to the two large Simms scrolls in which the name was picked out brilliantly in red carnations. The idea commends itself to exhibition organisers in the more arid countries.

Survey among Subscribers

THE REPLIES to the questionnaire sent out in August are pouring in at the time of going to press. Normally it is difficult to obtain much response, but a large number of replies have been received and many have made most illuminating and helpful comments. Considering our far-flung readership, many more may be expected to come in over the next three months.

Naturally it will take some little time before the replies can be collated and analysed, but already one or two points are obvious from a cursory survey. One is the high readership per copy and the other is that a very high percentage of readers consider that WORLD CROPS is fulfilling its aim and purpose.

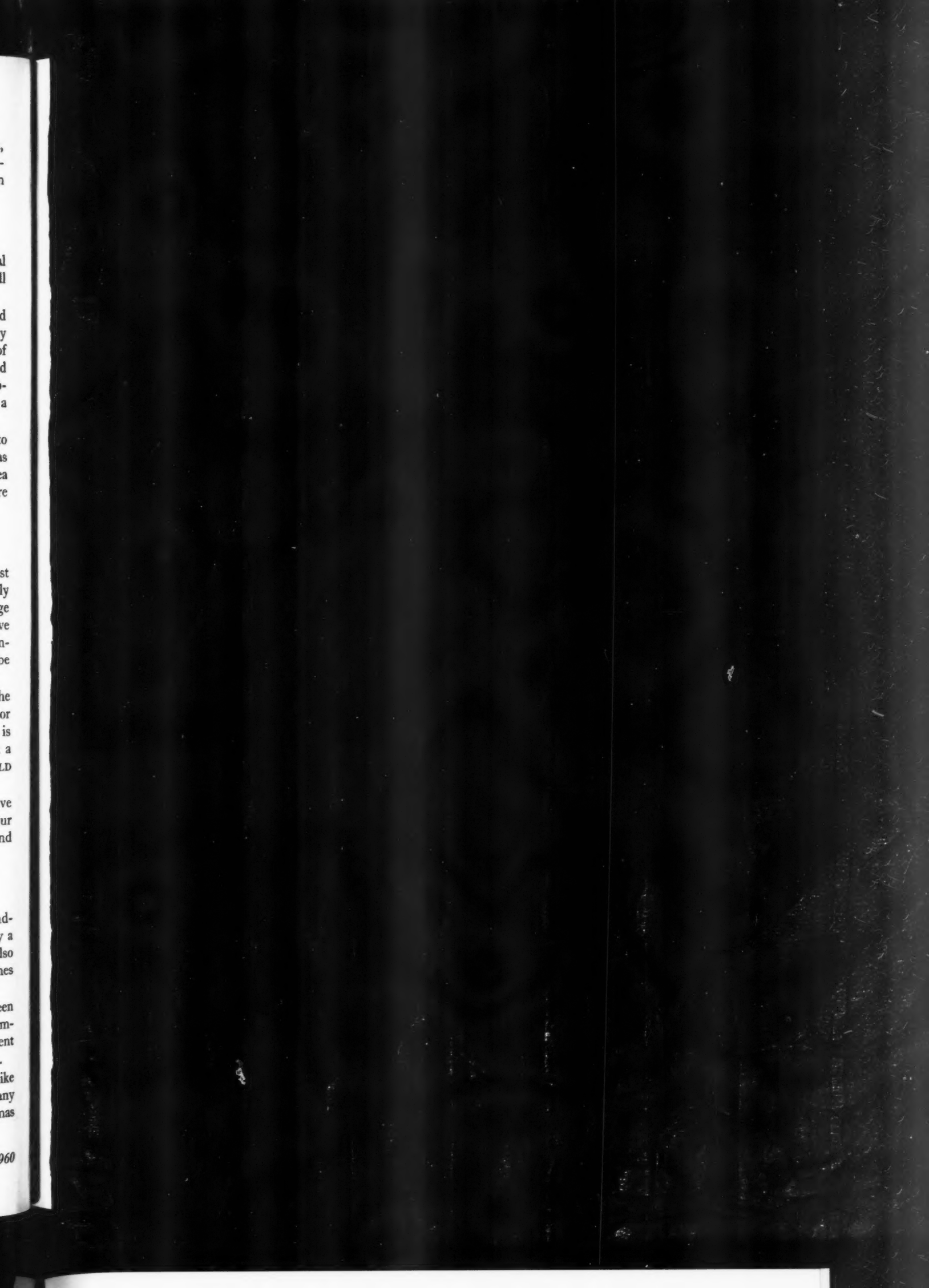
May we say 'thank you' to all those readers who have given their time and taken the trouble to reply to our rather lengthy questionnaire. The results will redound to our mutual benefit.

Christmas is coming

A GOOD way of expressing your appreciation of kindnesses and help received during the past year is by a Gift Subscription to WORLD CROPS. This will also serve as a constant reminder of your good wishes throughout the coming year.

A Subscription Order Form is to be found between pages 446 and 447. The subscription should accompany the order; the name and address of the recipient should be written in block capitals to avoid mistakes.

In view of our far-flung readership, we would like to take this early opportunity of wishing our many friends in all parts of the world a Merry Christmas and a Happy and Prosperous New Year.



Feeding the World's Millions—I

N. C. WRIGHT, C.B., M.A., D.SC., PH.D.*

The distinguished author of this paper first assesses the adequacy of current food supplies and in the second part he will consider whether the trend of world food production is sufficient to meet future requirements.

SINCE the types of food—even of staple foods such as cereals—vary from country to country, it is necessary in any comparisons of total food consumption to convert all foods to a uniform basis which, by common consent, is its energy content expressed in calories.

Before the war the British diet furnished an average of about 3,000 calories per head per day. On two subsequent occasions, in the critical period of shipping shortage in 1940-41 and in the post-war supply and currency crises of 1946-47, the level fell to slightly below 2,800 calories. The results of an extensive survey of the body-weights of adults showed a definite, if small, loss of body-weight during this period, when the calorie level was reduced to 2,800 per head per day, and there was a parallel loss of weight in children.

Under-nutrition

From such figures as are available, it appears that the food supplies of countries representing only about 20%, or one-fifth, of the world's population exceed this calorie level of 2,800. On the other hand, the food supplies of countries representing no less than 60% of the world's population actually fall below 2,200, of which nearly half are below 2,000—a figure 800 calories less than that at which British adults and children started to lose weight.

It is significant that all the 21 countries which exceed the 2,800-calorie level are located in either Europe, North America, Oceania or the River Plate area of South America. Of the 50 remaining countries for which figures are available, only eight are located in Europe; the remainder are in the under-developed regions of the Near East, the Far East, Africa and Latin America, chiefly in the tropics and sub-tropics.

It must, of course, be recognised that the food requirements of these latter countries are lower than those of Britain, for with higher environmental temperatures, the requirement is lowered, the smaller stature and lower body-weight of most tropical inhabitants reduces their food needs, and the relatively lower level of working activity which is typical of less developed areas also reduces the need for food.

On the other hand, it must equally be recognised that, apart from the environmental temperatures, the other two variables are themselves affected by the level of food intake; low supplies of calories are an important contributory cause of reduced stature, lower body-weight and reduced working activity.

Vicious circle

In this sense food requirement figures must surely always be considered from a dynamic rather than a static aspect, otherwise man will find himself in a vicious circle of poverty leading to low food intake; low food intake leading to reduced body-weight and low levels of activity; low levels of activity leading to decreased productivity; and decreased productivity leading to still greater poverty.

Observations in countries where

Photo: UNRRA, through FAO

Hungry people crowding round a mobile relief kitchen. Only about one-fifth of the people of the world are receiving enough food

* Deputy Director-General, Food and Agriculture Organisation of the United Nations.

Photo: Inter-Church Aid

A queue of Arab children receiving a cup of milk—a gift sent through the churches

there have been degrees of under-nutrition varying from severe though temporary food shortages, as in the two world wars, to semi-starvation, due to natural famines, indicate that under such conditions there is not only weight loss and reduction in physical activity, but also characteristic behaviour symptoms, such as lack of mental alertness and coherent and creative thinking, with apathy, depression and irritability, leading in extreme instances to an increasing loss of moral standards and social ties.

There is also clear evidence that such under-nutrition is one of the most potent factors in lowering resistance to tuberculosis, a finding incidentally confirmed in many countries during the two world wars, when even temporary conditions of severe under-nutrition resulted not only in a more rapid fulminating course of the disease, but in a two- to four-fold increase in mortality. There seems to be general agreement that the course of infectious diseases, once established, is usually apt to be less favourable in the severely under-nourished person.

It needs also to be emphasised that a deficiency in the total food supplies of a country, when expressed as an average figure, fails to reveal differences between different areas and different social groups within that country, and therefore to give a true measure of the degree of under-nutrition of the poorer-fed sections of the population. Further, a country whose population lives merely at a subsistence level, with no possibility of building up local reserves and with no adequate communications for distribution of relief supplies, is particularly vulnerable to seasonal changes in food production, and catastrophically vulnerable to crop failures, which can rapidly produce famine conditions.

Frequency of famines

It is seldom realised how frequent has been the occurrence of such famines in the past. Thus, in the first 1,800 years of the present millenium there were in Europe—at that time a relatively under-developed region—no less than 350 famine years, *i.e.* a recorded famine in one year out of every five. In Britain itself there was a recorded famine in one year out of every 10. These figures, however, pale into insignificance beside those of China, which experienced more than 1,800 famines during the 2,000 years for which records are available—an average of one famine in every year of its history.

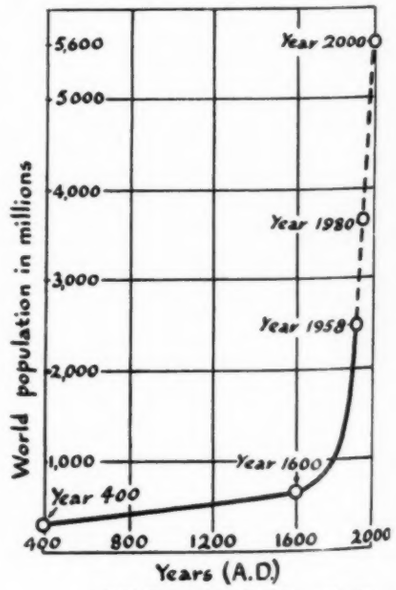
In spite of greatly increased populations, such famine conditions are now virtually non-existent in Europe, for the improved agricultural production, the provision of adequate food storage facilities, and the availability of easy means of communication, safeguard European countries from the risks of very serious food shortages. Such conditions do not apply to many less-developed countries, where, as a result, famines are a constant threat and temporary local food shortages are endemic.

Malnutrition

In most under-developed countries there are inadequacies not only in the quantity of food, but also in its quality, leading to malnutrition as well as to under-nutrition. In the developed countries the diet is commonly drawn from a wide variety of sources, and the staple cereals and starchy roots do not constitute an abnormally high proportion of the total food intake. The reverse is true of the under-developed countries.

Thus, whereas the proportion of staple cereals and starchy roots in the North American diet is estimated to be only 25% and in the British diet only 31%, in Europe as a whole it is 50%, in Latin America 54%, in Africa 66%, in the Near East 71% and in the Far East over 73%. Conversely, while the proportion of animal products—milk, meat, eggs and fish—in the North American diet reaches the exceptionally high figure of 40% and in the British diet is as high as 27%, the figure for Europe as a whole is estimated at 21%, for Latin America 17%, for Africa 11%, for the Near East 9% and for the Far East 5%.

These differences are reflected in a shortage of protein, and particularly of animal protein, in the diets of the



U.N. Populations Division estimates

Estimate of the population of the world in 2000 A.D.

under-developed countries, the figures for total protein falling from 92% in North America to 57% in the Far East, and for animal protein falling still more strikingly from 66% in North America to only 7% in the Far East, a ten-fold difference.

Simultaneously, owing to the lack of variety in the diets of the less-developed countries, and particularly to the shortage of animal products, such diets also tend to lack adequate quantities of vitamins and essential mineral constituents. This in turn leads to the incidence of specific deficiency diseases—diseases which are now seldom encountered in the more developed countries.

Photo: Gov. Inf. Services, Hong Kong. Crown Copyright Reserved

Overflow from China

Between 1949 and 1959 an estimated 1 million persons entered Hong Kong from China. The island colony was already greatly overcrowded and many of the newcomers inevitably became squatters. The shanty town they built, using scrap lumber, corrugated iron and even cardboard, spread over the hillsides outside the urban areas like a rash

Deficiency diseases

Of these diseases, probably the most widespread in its incidence and the most damaging in its effects is that now known from its original African name—as *kwashiorker*. This condition is found most frequently in children between weaning and about 4-6 years of age; that is, during the first few years after the child is transferred from a milk diet to a diet which, in under-developed countries, is liable to consist largely of cereals.

During this period the protein requirements for growth are high; at the same time the child is particularly vulnerable to various infections which themselves tend to precipitate *kwashiorkor*. The typical symptoms of the acute condition are oedema,† wasting and skin sores, accompanied by liver degenerations which, unless promptly treated by the administration of supplementary protein, usually leads to its death.

A new generation of disease and malnutrition caused by faulty nutrition and overcrowded conditions

Such acute cases are only a small part of the total problem of protein deficiency in children. Less acute cases are widely prevalent and may not only result in lasting though concealed damage, particularly to the liver, but frequently exacerbate the effects of infections, such as measles or dysentery, with a resulting high mortality rate not found among better-fed populations.

Avitaminosis is prevalent in certain areas of Africa, Asia and Latin America. Pellagra is still endemic among populations subsisting largely on a maize diet; it is found in areas of Africa and the Near East and, sporadically, in Latin America. Rickets, normally rare in tropical countries, exists nevertheless in Africa, in parts of Asia and in the Near East. Finally, nutritional anaemia, associated with iron deficiency, still constitutes a serious health hazard, especially among expectant mothers and young children, and is the principal factor affecting maternal mortality in a number of under-developed countries.

(To be continued)

† Oedema : Accumulation of watery fluid in the body tissues.

Photo: Inter-Church Aid

A queue of Arab children receiving a cup of milk—a gift sent through the churches

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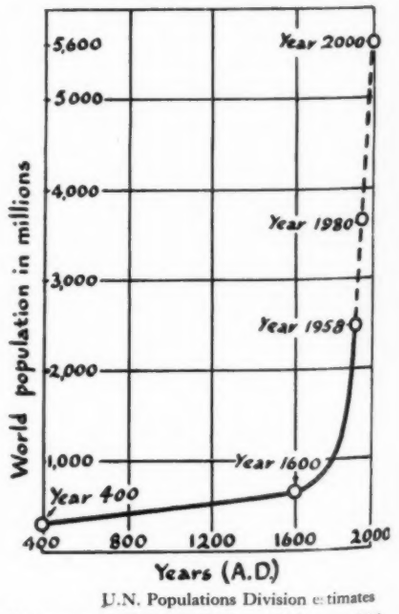

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under-developed countries, the figures for total protein falling from 92% in North America to 57% in the Far East, and for animal protein falling still more strikingly from 66% in North America to only 7% in the Far East, a ten-fold difference.

Simultaneously, owing to the lack of variety in the diets of the less-developed countries, and particularly to the shortage of animal products, such diets also tend to lack adequate quantities of vitamins and essential mineral constituents. This in turn leads to the incidence of specific deficiency diseases—diseases which are now seldom encountered in the more developed countries.

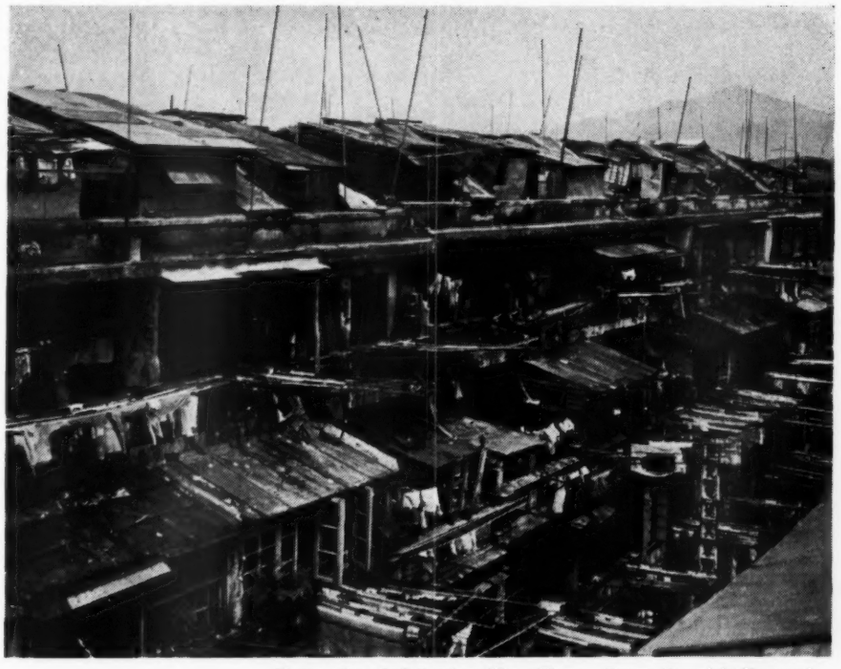


Photo: Gov. Inf. Services, Hong Kong. Crown Copyright Reserved

Overflow from China

Between 1949 and 1959 an estimated 1 million persons entered Hong Kong from China. The island colony was already greatly overcrowded and many of the newcomers inevitably became squatters. The shanty town they built, using scrap lumber, corrugated iron and even cardboard, spread over the hillsides outside the urban areas like a rash

Deficiency diseases

Of these diseases, probably the most widespread in its incidence and the most damaging in its effects is that now known from its original African name—as *kwashiorker*. This condition is found most frequently in children between weaning and about 4-6 years of age; that is, during the first few years after the child is transferred from a milk diet to a diet which, in under-developed countries, is liable to consist largely of cereals.

During this period the protein requirements for growth are high; at the same time the child is particularly vulnerable to various infections which themselves tend to precipitate *kwashiorkor*. The typical symptoms of the acute condition are oedema,† wasting and skin sores, accompanied by liver degenerations which, unless promptly treated by the administration of supplementary protein, usually leads to its death.

A new generation of disease and malnutrition caused by faulty nutrition and overcrowded conditions

Such acute cases are only a small part of the total problem of protein deficiency in children. Less acute cases are widely prevalent and may not only result in lasting though concealed damage, particularly to the liver, but frequently exacerbate the effects of infections, such as measles or dysentery, with a resulting high mortality rate not found among better-fed populations.

Avitaminosis is prevalent in certain areas of Africa, Asia and Latin America. Pellagra is still endemic among populations subsisting largely on a maize diet; it is found in areas of Africa and the Near East and, sporadically, in Latin America. Rickets, normally rare in tropical countries, exists nevertheless in Africa, in parts of Asia and in the Near East. Finally, nutritional anaemia, associated with iron deficiency, still constitutes a serious health hazard, especially among expectant mothers and young children, and is the principal factor affecting maternal mortality in a number of under-developed countries.

(To be continued)

† Oedema : Accumulation of watery fluid in the body tissues.

Photo: *Oxford Mail*

The results of a variety trial at Oxford. The variety sown is Inra 353, planted in April and harvested in August

Silage Maize — *Recent Developments in Northern Europe*

E. S. BUNTING, B.SC., PH.D.

The area under fodder or silage maize in the world has more than doubled in the past five years. Even before the recent increases in acreage, maize was probably the most widely grown arable fodder crop in the world.

THERE is so much variability within the species that plant breeders have been able to select types suitable for a wide range of conditions, and in many areas maize will produce a greater bulk of material—and more dry matter per unit area—than any other annual crop. Moreover, the chemical composition of the maize plant, when nearly ripe, makes it almost ideally suited to preservation as silage. In the U.S.A., for example, about 7 million acres of maize are ensiled each year, and maize silage is by far the most important winter feed for livestock.

Nevertheless, so vast is the acreage of maize grown for grain production that the value of maize as a fodder crop is often overlooked. Thus, in the U.S.A. the area of maize harvested for grain is more than ten times the area harvested for silage, and five years ago a similar relationship probably held for maize production in the world as a whole. Frequently, therefore, maize grown for fodder or ensilage seems to be regarded as rather a poor relation of maize grown for grain, and occasionally it is even implied that the harvesting of maize for silage is something of a rescue operation conducted to save a crop originally destined for grain production.

Increasing acreage

It is certain that proper regard will be paid in future to the importance of silage maize as a crop in its own right. In the U.S.S.R., for example, the acreage of maize has risen since 1955 from around the pre-war average of 11 million (4.4 million ha.) to more than

55 million (22 million ha.) and nearly half of the present acreage is said to be harvested for silage.[1] On a percentage basis the increase in acreage of silage maize in East Germany has been even greater. From a few thousand acres each year prior to 1955, the area sown increased to nearly half a million (190,000 ha.) in 1958, and the proposed target for 1963 is nearly 1.25 million acres (490,000 ha.). Of perhaps even greater significance is the fact that the cultivation of maize for grain production in East Germany remains of trivial importance (see Fig. 1).

In Western European countries the expansion of maize acreage has been somewhat slower, but even in such northern areas as Sweden, Netherlands, Britain, Northern France and N.W. Germany, maize for silage is now regarded as a serious competitor with such traditional fodder crops as 'roots' (turnip, swede, fodder beet) and kale. With the development of better varieties more satisfactory methods of chemical weed control and of efficient machines for harvesting the crop, the production of maize silage in Central and Northern Europe is much more economical than it was a few years ago.

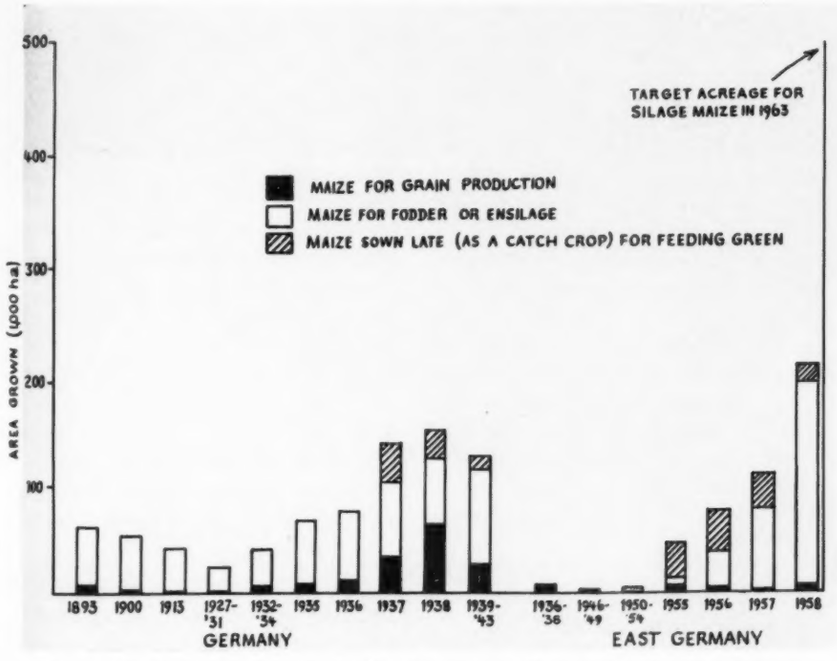


Fig. 1. Analysis of maize production in pre-war Germany and East Gemany

Correct harvesting for silage

Palatable silage can be made from maize harvested at any stage of development, but there is little doubt that the most appropriate time to harvest the crop is when the grain has reached the milk or dough stage of development. The plant has then produced nearly as much dry material as it is capable of, and in content of water and chemical composition it is almost ideal for preservation as silage.

Since maize is susceptible to frost, the crop will normally be harvested in Northern Europe in late September or early October and correct choice of variety (or type of variety) is essential if the maize is to reach the required stage of development by this time. Very late varieties, which will only reach the flowering stage by harvest, are likely to produce silage of inferior quality, while very early varieties are usually too low yielding to be economic.

Use of maize hybrids

Fortunately, productive and relatively early hybrid varieties are now available. Hybrid varieties of maize were originally developed in the U.S.A. Many of the hybrids from the northern tier of States, especially Wisconsin, have proved very useful in Europe and their introduction helped to stimulate commercial interest in this crop. The American hybrids, however, are not very well adapted to the cool early summer conditions often met with in Northern Europe, and they are now being superseded by hybrid varieties developed in European countries. Hybrid maize breeding in Europe is of relatively recent origin and considerable improvement in varieties may be expected during the next few years.

Planting and harvesting

For best results with maize in Northern Europe full advantage must be taken of the available growing season—maize should be sown as early as possible and harvested as late as possible, consistent with the avoidance of severe frost. The susceptibility of maize seedlings to frost has probably been exaggerated in the past; frequently farmers were recommended to delay sowing until all danger of frost was over, and in Britain this usually led to sowings in the latter half of May, or even early June.

It is now known that maize should be sown at the end of April or very early in May in Central and Southern England; the mean soil temperature

The differences in early development between different varieties of maize. Left to right: *Rheintaler Orla* 266, *Italo* 225, *White Horsetooth, Wisconsin* 255, *Wisconsin* 416*AA*

A silage crop, variety Warwick 277, sown at the rate of 35 lb. per acre and treated with a pre-emergence spray of simazin. Note the clean pick-up of the silage harvester

at sowing depth is then 50-55°F (10-13°C) and the seedlings, which emerge about 14 days after sowing, will tolerate the slight frosts which may occur later. The results of trials in other parts of Northern Europe also indicate that late April to mid-May is the most appropriate time for sowing maize; indeed, where conditions are such that a later sowing must be used, it is probably inadvisable to grow maize at all.

For this reason, heavy clay soils, which warm up slowly in the spring, should be avoided, otherwise maize can be grown successfully on a wide variety of soils.

Need for plant food

The two essentials are good drainage and an adequate supply of nutrients. On most soils nitrogen is likely to be the limiting factor and applications of 80-100 lb. per acre are usually economic in Northern Europe. It is not clear from the results so far obtained whether all the nitrogen should be added to the seedbed or whether some should be kept for subsequent application. What is abundantly clear is that maize should not be regarded as a crop for poor land, for the great potential productivity of maize can only be achieved under conditions of high fertility.

In this respect, the recent results from the U.S.A. have been illuminating. During the 1940s maize yields in the U.S.A. increased rapidly following the introduction and spread of hybrid varieties. By 1950 nearly all the main areas for maize production in the U.S.A. were sown to hybrid varieties; nevertheless, yields have continued to increase and are now almost double what they were 20 years ago. Much of this increase can be attributed to better crop production methods, and in particular to the much higher levels of nitrogen manuring now used.

Weed control essential

High levels of fertility for crop production also implies freedom from weed infestation. Maize is quite surprisingly sensitive to weed competition; even relatively small numbers of weeds, emerging and growing with the crop, can reduce yields by half.

This was always appreciated and in the past it was the usual practice in the U.S.A. to sow maize in 'hills' with three or four seeds planted 'on the square' to permit cultivation in both directions. In Northern Europe the danger of weed infestation is even greater than in the U.S.A., because maize grows quite slowly in the cooler early summer conditions. In Britain it is not uncommon for maize to be only 18-20 in. high even two months after sowing.

Methods of control

Fortunately, considerable advances have been made recently in the chemical control of weeds in maize. The best known of the new herbicides are the related chemicals known as simazine and atrazine. These chemicals have a persistent effect and they are normally applied before the crop emerges at the rate of 1-2 lb. per acre of active chemical.

Under favourable conditions such applications will keep the maize crop free from most annual weeds throughout its period of growth. If the soil is dry at the time of application and continues dry for several weeks afterwards (as occurred in many areas in 1959), then insufficient chemical may be dissolved to give really efficient control of weeds; moreover, under these conditions the chemical may persist long enough to endanger the growth of the subsequent winter crop, because not only weeds but also most crop species are susceptible to simazine or atrazine.

Under normal rainfall conditions in Northern Europe, however, these chemicals may be expected to give excellent control of weeds on maize with no attendant rotational problems, and it is already evident that their introduction has greatly enhanced the prospects for maize by minimising what

was formerly a major hazard in crop production.

Pests and diseases

Provided the early season problems have been overcome, success with the silage maize crop in Northern Europe is almost assured. Relatively few pests or diseases of the more mature crop have been reported. Corn borer is known to be prevalent in Central and Southern Germany, but is not as yet a serious pest in more northern areas. Smut damage to the developing ears is occasionally encountered, but it seems not unlikely that the lower summer temperatures in Northern Europe will limit the number and severity of the diseases likely to be met.

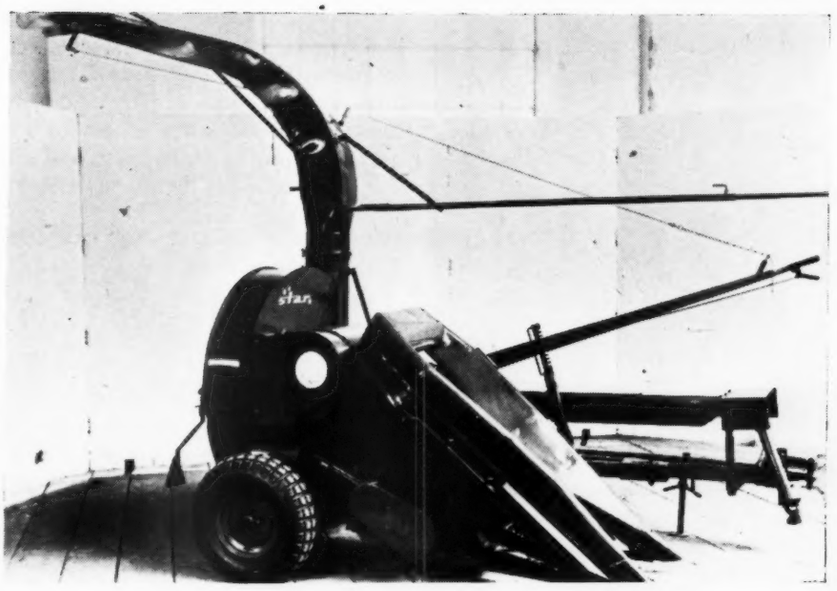
Harvesting the crop

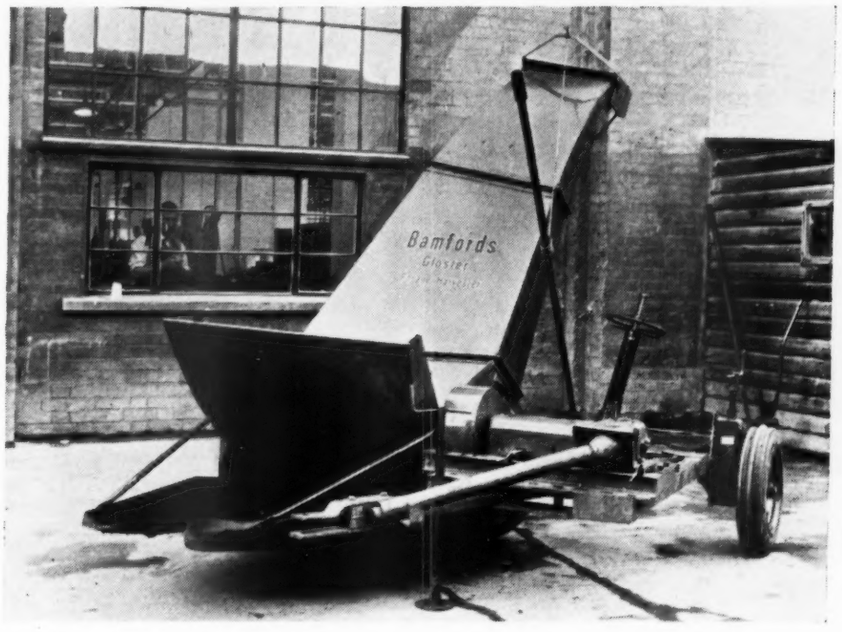
The main problem in the past has been that of harvesting the crop efficiently, expeditiously and economically. The recent developments in forage harvesting machinery—which seem likely to overcome the difficulty—have probably done more than anything else to attract attention to the possibilities of silage maize for Northern Europe. In the U.S.A., of course, the harvesting of the silage maize crop has long been mechanised—but the machines were too costly and uneconomic for European farmers with smaller acreages.

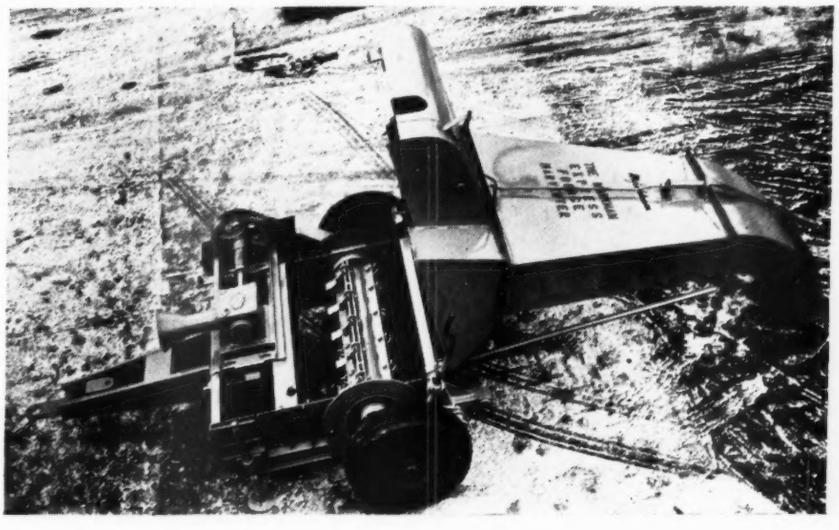
Harvesting machines

Within the past five years a number of machines for harvesting forage crops have been designed in Europe. In general, they are smaller, simpler and cheaper than American models and, in Britain at least, they are rapidly becoming standard pieces of equipment, even for farms of only about 100 acres. These machines were primarily designed for harvesting grass and leguminous fodder crops and not all of them are suitable for harvesting maize or other row crops. For some of them, however, row-crop attachments are now available and very satisfactory results have been obtained with maize.

The machines cut and shred the crop—blowing the product into an accompanying trailer. The time needed







Various types of forage harvester which can be used for cutting silage maize. The two top pictures show the special guide attachment fitted

France: A forage harvester in operation, showing the function of the special maize attachment which passes between the rows and guides the stalks into the machine

for harvest—and, equally important now, the labour requirements—have been much reduced. Moreover, with mechanical harvesting it is much easier to conserve the crop satisfactorily.

Good-quality silage largely depends on speed in filling the silo and the use of finely chopped or shredded material. Both these practices help to exclude air from the ensiled product and so promote a rapid and appropriate fermentation process.

Silage making

Fairly mature maize has a low content of protein and a very high carbohydrate content and no additive, such as molasses or acid, is required—indeed, maize is probably the easiest crop to ensile satisfactorily.

Various types of silo are used. Pit (or trench) silos and clamp silos are most common in Europe, while tower silos made of wood, concrete or steel predominate in the U.S.A. Some spoilage is likely to occur in any type of silo, but, given equal operational skill, the amount will be related to the area of surface exposed to the air. Tower silos are thus the most efficient, but they are also the most expensive to construct.

In pit or clamp silos spoilage can be reduced by careful packing and continuous consolidation of the material during filling and by sealing the surface and sides of the silo after it has been filled. A tractor is usually driven over the material to consolidate the mass and lime, soil or even plastic covers are used as a seal. Reasonable care and attention to detail when making silage is worthwhile, since if maize with a water content of 75-80% is ensiled in a pit or clamp silo with a surface area of 40 ft. by 20 ft. and the top 6 in. is spoiled, then at least 10 tons of silage is wasted.

Utilisation as feed

Well-made maize silage will keep indefinitely, but, if required, it may be fed within a few weeks of the silo being filled. It is an especially useful feed for beef animals; and for high-yielding dairy cattle, supplementary protein will be needed in the ration, but maize silage can be used as the basic feed for all classes of livestock. Recent advances in crop production techniques seem to ensure that it will play an increasingly important part in animal husbandry technique in Northern Europe.

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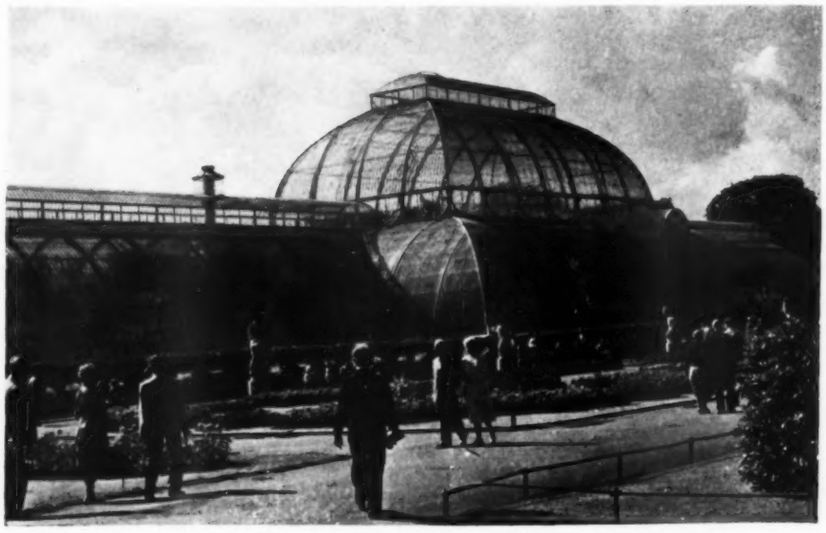
Corrosion at Kew



The Great Palm House at Kew contains many species of palms, tropical trees and exotic plants growing in artificially created tropical conditions

Such was the extent of the corrosion of the Great Palm House at Kew Gardens, England, that the Ministry of Works in 1952 considered erecting an entirely new building. Built in 1845-48, the Palm House for a long time was the largest glasshouse in the world. The framework of wrought-iron ribs and glazing bars carries 47,700 sq. ft. of glass; the building also contains a certain amount of cast iron in columns, staircases, balconies and balustrades. Temperature and high humidity had done their worst and in places the main supporting ribs were partially eaten through by rust and were no longer safe.

In view of the prohibitive cost of a new plant house of this size, it was decided to save the building by extensive repair work.

All ironwork surfaces were derusted and cleaned with mechanical chisels and wire brushes, while needle guns were used on some of the broader surfaces. A technique was developed for welding steel plates to cast iron and underfloor short cast-iron columns which were severely corroded were replaced, using cast aluminium which had been given anti-electrolytic treatment. To eliminate any rust residue, a primer wash of resin-based phosphoric acid was applied to the iron, followed by a rust-inhibiting primer coat, an undercoat and two finishing coats of specially prepared paint. The Great Palm House was saved.

A Ministry of Works film of these operations is to be shown at the Corrosion and Metal Finishing Exhibition, which takes place from 29 November to 2 December at Olympia, London.

Vertical Mulching

J. M. SPAIN and J. B. LILJEDAHL*

The conservation of soil and water is one of the greatest tasks confronting American agriculture, according to the authors.

MUCH farm land in the U.S.A. is being eroded away, perhaps not so dramatically as in previous years, but nevertheless steadily and at an appreciable rate. Fields and pastures suffer in summer from lack of water, which a few weeks earlier raced across them, carrying tons of irreplaceable topsoil, but failing to fill to capacity the water reservoir in the soil on which it fell.

Faulty land use

Many springs and small streams have ceased to flow. Rivers flood, but too often fail to meet navigational and water supply needs much of the time. Man-made reservoirs, lakes and ponds, large and small alike, are silting up so rapidly that many will have to be abandoned if erosion losses continue at the present rate.

The existing conservation practices do not completely meet the needs of farmers whose land resources are thus being depleted. A large part of the problem can be attributed to the fact that farmers simply do not like to lay out contours, maintain terraces and farm point rows. To them the immediate returns to be realised from such practices are not enough to justify the extra time, trouble and cost.

Vertical mulching is a new soil management practice, initiated at Purdue University, which promises to help in the solution of this problem. It is a simple though important modification of subsoiling—a practice now fairly common.

Fertilising with subsoiling

Subsoiling is done to open and shatter the soil to various depths, depending on the tool employed and the nature of the soil being treated. The idea is that water and air can move much more freely into this shattered subsoil, and plant root growth will thus be stimulated. In some cases, notably where hard pans† were present, subsoiling has paid, but in most cases it has not been profitable. In the mid-west and eastern parts of the U.S.A. this may be largely due to infertile and acid subsoils, into which plant roots will not grow even after the subsoil has been shattered.

To remedy this situation Dr. Helmut Kohnke initiated research on subsoil fertilisation at Purdue in 1951; he introduced lime and fertiliser into the subsoil, when subsoiling, to encourage plant roots to grow abundantly and penetrate deeply into the soil. Acid subsoils were limed and infertile subsoils were fertilised. Some of the results were promising, but after several years it was concluded that one should not expect immediate results. The long-term results, however, could be quite significant.

It became apparent that the subsoil channels were closed and sealed off in a year or so, and thus the main purpose served by the subsoil channel was to introduce lime and fertiliser and hold the subsoil open for perhaps one or two more years, thus encouraging deeper root growth.

Early trials

From this work the idea of vertical mulching originated. It seemed logical that if it were possible to fill the subsoil channel with organic material at the time of subsoiling the channel would be stabilised and would remain open and functional for several years, so prolonging the initial benefits of subsoiling, *viz.* improved aeration, increased water penetration and a consequent increase in the amount of

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† Impermeable layers of soil resulting from traffic or from an accumulation of silt or clay.

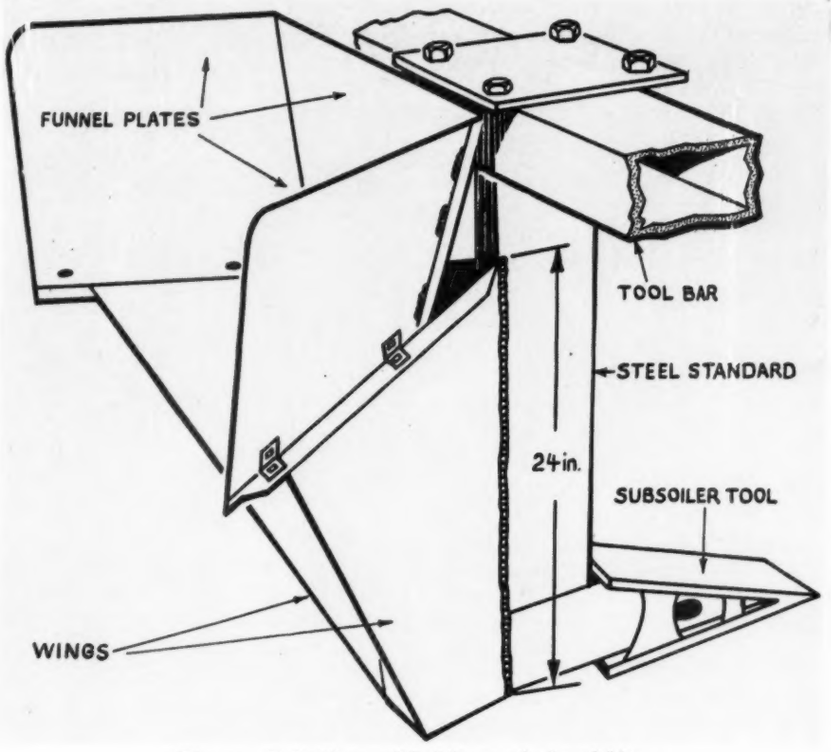

Fig. 1. Subsoiler modified for vertical mulching

moisture available during the growing season. It was hoped that these channels would operate in the same way as a root system and thus also encourage the development of such natural channels.

The available equipment was modified and used to establish the first trial plots. This subsoiler, mounted on the toolbar of a small crawler tractor, was modified by adding wings to hold open a V-shaped channel momentarily.

Subsequent trials

Following these preliminary operations, equipment was designed and modified specifically for vertical mulching: 1. A conventional subsoiler was modified by attaching wings and funnelling plates to open and direct the material into the channel (Fig. 1). The width of the channel formed by this modified subsoiler, when operated at an 18-in. depth, was 3 in. at the bottom and 6½ in. at the surface. 2. A 40-h.p. *Caterpillar* D2 tractor, equipped with a toolbar, was used as the power unit. The subsoiler was attached to this toolbar and a forage harvester was pulled from an extension of the swinging drawbar (Fig. 2). 3. A *John Deere* flail-type forage harvester was used to cut, chop and convey the crop residues. A 20-h.p. auxiliary engine was mounted on the harvester because of the difficulty in designing a p.t.-o. drive which could be used with a toolbar subsoiler.

A legume hay crop was used in the early trials, but it was found that this green material decomposed so rapidly that it failed to hold the channel open. The crop residues used in the subsequent operations were stubble and corn stalks. Any dry, highly carbonaceous material that is available in sufficient quantity on the field being treated should prove satisfactory. Corn cobs were tried successfully. The cob-filled channels were quite stable and should be long-lasting. Cotton burrs, wood chips, sugar-beet pulp and other agricultural and industrial by-products could be used if the cost of handling and transport is not excessive.

Observations

It soon became apparent that one of the most important applications would be in controlling run-off and erosion. It seemed likely that as long as the mulch-filled channel remained intact and reached the surface it would greatly increase water penetration into the soil.

This theory was confirmed a few months after the establishment of the first plots, when approximately 5½ in. of rain fell in three days on to sloping plots. After 2 in. of rain had fallen, water was seen to be running off the subsoiled plots and the control plots, but there was no surface water to be seen on the vertical-mulch plots. By digging into a channel, free water was found at about 12 in. below the surface. As the rain continued, the channels gradually filled up until at the end of the third day they were filled to overflowing.

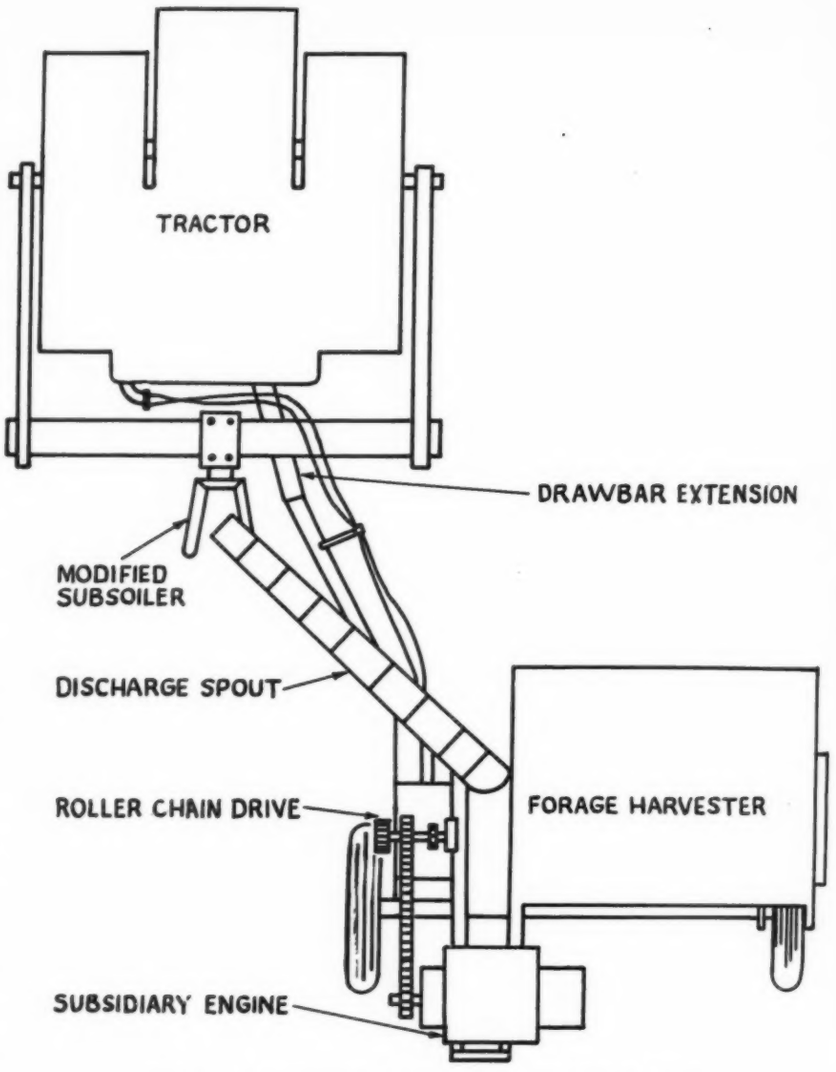

Fig. 2. Arrangement of equipment for vertical mulching

Discussion

The vertical-mulch channel thus assists in four ways:

1. Surface water can move freely into the soil down the vertical-mulch channel. In most soils the greatest obstacle to the infiltration of water is the crust—the upper $\frac{1}{16}$ in. of soil. When most soils are subjected to the beating of rain drops or to the turbulence of flowing surface water they form a highly impermeable, puddled surface layer. This factor becomes increasingly important as the organic matter in the soil decreases.

2. A greater surface area is active in absorbing water into the soil. If the sides of the channels are 20 in. deep and they are spaced 80 in. apart, then the absorbing surface area is increased by half. In most soils this increased area will probably be much more effective in absorbing water than the area initially available, *i.e.* the surface soil, because it is not exposed to the beating action of rain drops. The

organic matter—soil interface along the sides of the channel is apparently quite stable and its permeability should further increase as earthworm activity increases. Channels that have been in 18 months are still very prominent and stable and seem likely to function for 3-5 years.

3. The channel has a definite storage capacity, which in itself increases the initial infiltration of water into the soil regardless of what happens to the water after it gets into the channel. Some channels have an average cross-sectional width of 2-3 in. It is quite conceivable that 20-in. deep channels spaced 80 in. apart could store as much as ½ acre-inch of water. This amount of water could be literally poured on an area with such channels without any loss of water regardless of the slope.

4. As the vertical channel fills with water, pressure increases at the bottom of the channel outwards and the shape of the diffusion pattern may prove to be quite important.

In the foregoing discussion, completely filled and undisturbed channels are always assumed. The degree to which these channels can be filled and the extent to which they remain undisturbed will largely determine their life and effectiveness in controlling run-off and erosion.

For grassland farming

In grassland farming, fields could be vertical-mulched at the same time that they are established or renovated, using the stubble from a small grain crop for filling the channels if this is available. After establishment, there would normally be no cultivation and no disturbance of the mulch-filled channels during the life of the pasture.

Most soils erode only slightly under well-managed permanent grass, even in regions of high rainfall, but water losses are often large on the steeper slopes. Vertical-mulch channels approximately on the contour could serve as 'invisible' terraces on rolling grassland, trapping potential run-off and funnelling the water down into the subsoil.

With the usual cultural practices for cultivated crops, the surface soil is disturbed several times a year, being completely displaced when ploughed. For this reason vertical mulching for soil and water conservation seems more likely to suit grassland farming than the more intensive types of arable farming.

However, practices made possible by recent developments in mulch tillage implements, mulch and sod planters and chemical weed controls will make it easier to fit vertical mulching into more intensive row-crop or grain farming operations. Using a combination of these mulch farming practices, much more intensive rotations could be followed on sloping soils.

Summary

Vertical mulching is still in its infancy, but the indications are that it is potentially a very useful soil and water management practice. Its development stems from research in subsoiling and subsoil fertilisation concerned largely with improving subsoil conditions and deepening the plant root zone. In addition to this application, vertical mulching seems applicable to several other distinctly different problems, ranging from run-off and erosion control to drainage.

On the one hand, the amount of water available in the soil for plant growth is increased; on the other hand, surplus water is removed from soils where too much water is present for optimum plant growth.

Scholarships for Ghanaians

Mr. N. J. Dowuona Hammond, Trade Commissioner of the Ghana High Commission in London, recently visited the Massey-Ferguson School of Farm Mechanisation at Stoneleigh Abbey, near Coventry, in connection with a new scholarship training scheme for Ghanaian agriculturists. During his tour of the lecture rooms and workshops, Mr. Hammond met the first two trainees to come to Britain under the scheme—Mr. V. K. Agboka and Mr. E. Nettey, of the Department of Food and Agriculture in Ghana—who were nominated for their scholarships by the Minister of Agriculture in Accra.

The scheme provides for two students to come to the training centre for a four-month course of training in farm mechanisation and instructional techniques each year for the next five years.

The Trade Commissioner of the Ghana High Commission watches the two trainees working on a partly-dismantled diesel engine

New Pastures with Vast Promise

Clovers and Legumes for the Tropics and Sub-Tropics

K. F. BEAN

Relatively little research has been done on tropical and sub-tropical pastures. Australian scientists, after an organised attack on the problem in the last decade or so, are getting results which, if applied, could greatly increase yields in other large areas of the world.

WHILE many of the richer sections of the hot lands are highly developed agriculturally, the greater part provide at best only sparse grazing for cattle and sheep. Yet high temperatures, with rainfalls from 20 in. to 70 in. or more a year, should support vastly greater production, being favourable to both crop and pasture plants.

The situation parallels that existing 50 years ago in much of Australia's temperate southern lands. There, as in the tropics and sub-tropics today, huge areas of infertile land lay unproductive in spite of the favourable climate. The application of superphosphate was the first step in increasing fertility, but clovers were also needed to provide the nitrogen essential for sustained pasture growth. None of the common clovers, however, would survive the Mediterranean-type climate.

Subterranean clovers

It was not until subterranean clover —an obscure species from overseas never previously sown as a pasture legume—became established that the way was opened for pasture improvement and vastly increased agricultural production.

Natural pastures in the tropics and sub-tropics often provide inadequate diet even for the least demanding of livestock—the mature beef animal. The fibrous grass that commonly dominates the pastures is too low in protein, too low in energy nutrients and often too low in minerals for long periods of the year, particularly in winter and spring. Total yields rarely exceed 30 cwt. of dry matter an acre.

Yet many of these soils, when adequately fertilised, could grow five or six tons of dry matter during the summer.

Even the improved pastures in these areas are almost everywhere composed exclusively of grasses. Without legumes to provide nitrogen, they can only flourish on nitrogen-rich soils. Thus the primary need is for legumes

This spectacular growth of Sorghum alum *was sown only 13 weeks before this photograph was taken*

An experimental area in Queensland planted with a mixture of the legume Phaseolus lathyroides *and Rhodes grass. The native grazing in the background is in sharp contrast*

that will persist and continue to provide sufficient nitrogen to maintain the productivity of the grasses growing with them.

World-wide search

A search for new plants has produced several most promising legumes, often wild ones, from Rhodesia, South America and Indonesia, from South Africa and Hawaii, from Fiji, Mexico and New Guinea.

The job now is to adapt them to local conditions—by radiation and breeding where necessary—and to discover how best they can be used in different regions. Plants from 13 different genera have shown promise in some way or other during these exploratory investigations.

Despite the pasture underfoot, this beast prefers the protein-rich foliage of Leucaena glauca

Enormous possibilities

The extent of the material available and the work involved in assessing it thoroughly are obvious from the fact that the genera of *Desmodium* and *Indigofera* contain 600 and 900 species respectively. And within each of these species there are innumerable strains or varieties which often differ markedly. One strain may fail completely, while a second strain of the same species may prove a major success in the same environment.

A creeping lucerne pegged out to encourage rooting and multiplication by the production of daughter plants

Some of the more promising plants from overseas have never previously been sown in pastures and the conditions for their most effective use must therefore be worked out from first principles. Seed production from these wild species is a major problem and large-scale agronomic trials must often await its solution.

In some areas of Queensland there is already evidence that potential production from sown pastures is at least five times that from native grass. Improved pastures have carried one beast to 2½ acres, compared with a beast to 10 acres of native grassland. Moreover, the beasts on the improved pastures have continued to gain weight through the critical winter-spring period, when losses of 50-100 lb. a head are generally suffered by cattle on native pastures.

Selected legumes

Among the legumes selected by the C.S.I.R.O. (Commonwealth Scientific and Industrial Research Organisation) for improvement by breeding, *Indigofera spicata* is in many respects the most promising, but it contains a toxin poisonous to many grazing animals.

Radiation has been used to induce mutants low in the toxin, but further progress awaits the identification of the poisonous compound and a simple test for its presence that can be used on the many thousands of plants involved in the breeding programme.

Lotononis bainesii, from the mountains of South Africa, is the only frost-resistant sub-tropical legume among the many hundreds introduced from overseas. Its main drawback is its susceptibility to the legume little-leaf virus, and an attempt is being made to produce virus-resistant mutants by radiation.

Phaseolus atropurpureus, from Mexico, is also the subject of a major breeding project and some second-generation plants are very promising. Other breeding programmes concern *Medicago sativa* (lucerne) and *Trifolium repens* (white clover).

Leguminous shrubs

The scientists are also growing and exploiting leguminous shrubs and trees which can play a part in some of the varied tropical and sub-tropical environments in Australia.

The tropical tree *Leucaena glauca*, for instance, seems to have considerable potential on well-drained soils where frosts are not severe or protracted. It is already widely planted in many tropical countries to maintain soil fertility and as a shade tree with other crops, to reclaim waste grasslands, as an aid to soil conservation and as a fodder plant. Such unorthodox diet trees and shrubs abound in the tropics.

Cattle love the leaves of this tree and it is strongly drought-resistant. The protein content of its leaves ranges from 22-35% and is commonly higher than that of lucerne. In Hawaii, where cattle graze it, yields of a ton or more of protein an acre a year are reported, and it will stand repeated cutting for many years. Regrowth after cutting is rapid—a strain in Peru yielded at the rate of 6.6 tons of green herbage an acre in 10 weeks following 'stumping' to within 12 in. of the ground in early summer.

One of its main drawbacks as a stock feed is the presence of an alkaloid, mimosine, which can sometimes be injurious to horses and pigs and even to ruminants, including sheep and cattle. Examination of 33 different strains, however, suggests that it should be possible to breed a high-yielding, free-seeding strain with a low mimosine content.

Hybrid perennial grass

A newcomer to the world's fodder plants is making spectacular headway in Australia, although it is still the subject of great argument there and in other countries. It is a perennial grass, but a grass which can grow up to 12 ft. in height. Its name is *Sorghum almum*, a species believed to have originated in the Argentine from a natural cross between a cultivated sorghum and Johnson grass, *Sorghum halepense*, a dangerous sub-tropical weed.

First tried out in Australia in 1947, it out - yielded all other grasses. Graziers co-operating in the trials were so impressed they built up seed stocks and in five or six years it was widely disseminated. They continued to harvest seed and extend their acreage, even when state governments became worried about the possible spread of this close relative of the pernicious weed, Johnson grass, and prohibited the sale of the seed.

Those early fears have not been borne out. Nowhere has *Sorghum almum* proved difficult to eradicate. It certainly does not appear to present a weed threat in areas with up to 30 in. of rain and the evidence does not suggest that it would get out of hand in areas of higher rainfall. The seed, however, cannot be readily distinguished from that of Johnson grass and this could present problems in seed testing and certification.

Enormous productivity

The outstanding characteristic of the species is its enormous productivity. One experimental plot produced nearly 6 tons of dry matter an acre 12 weeks after sowing. A field of 560 acres sown in 1950 has fattened a beast an acre throughout each subsequent year, a sixfold production increase above native pasture.

Live-weight gains of up to 4 lb. a head per day have been recorded, while gains of 2 lb. are the rule rather than the exception. It also gives substantial seed yields even after heavy grazing, while adequately rested paddocks have yielded up to 1,400 lb. of seed an acre. In Australian terms, seed could thus be sold for as little as a shilling or two a pound, an important point in the economics of large-scale land development and pasture improvement.

This plant is drought-resistant, but it needs a fertile soil, and even in fertile soils the nitrogen level must be kept up if high production is to continue for more than a year or so. Legumes are essential to long-term success. Late summer and autumn grazing allows legumes, such as lucerne, to develop among the sorghum. The legumes provide valuable high-protein forage during winter, and this perennial sorghum shoots again in early summer, when the cycle of growth begins again.

Possibilities in land reclamation

The scientists and graziers who have been working with *Sorghum almum* are vastly impressed with its possibilities and believe it has a special place in the development of millions of acres of scrub soils as a pioneering crop, since it can be readily established after 'burns' and it provides a quick return that will cover all clearing costs.

It is now economical to plough out native pastures or scrub suckers if the land is then sown with improved perennial pastures based on *Sorghum almum* mixed with other grasses and suitable legumes.

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Fertilisers and Food

Two Million Dollar Programme

A panel of fertiliser industry representatives has recommended that FAO undertake a $2-million 5-year programme, to be financed by the industry, to expand and improve the use of fertilisers in crop production as part of the Freedom-from-Hunger Campaign.

Represented at the meeting were the International Potash Institute, the International Superphosphate Manufacturers' Association, the Centre d'Etude de l'Azete, and the Sulphur Institute. Observers were present from the National Plant Food Institute (U.S.A.), the Foundation for International Potash Research, and the Olin Mathieson Chemical Corporation.

The budget evolved by the panel, in collaboration with the FAO secretariat, calls for expenditure of $350,000 in the first year and $450,000 in the second. The programme would make an annual contribution of $30,000 to the central operating fund of the Freedom-from-Hunger Campaign.

The meeting, in its report to the Director-General and to the industry, said that the aim of the programme is to stimulate the interest of governments and farmers of less-developed countries in the efficient use of fertilisers, and to provide governments with the advice and information necessary for developing national fertiliser programmes. It would achieve this through a field programme of fertiliser tests and demonstrations and through developing soil-testing laboratories and services as a means of improving the use and management of fertilisers.

Another part of this important programme was the preparation of marketing and development studies in the field of fertilisers for the use of governments in their programmes of agricultural improvement.

Bacteria as a Living Insecticide

DR. J. WEISER*

IN the search for new insecticides much attention is being given to producing substances which are sufficiently selective to destroy only the pests and not to affect any useful associations of animals, insects and plants and sufficiently non-toxic to avoid any risk of poisoning man or beast, either directly by the agent employed or through its residues accumulating in the soil and reaching toxic levels.

This has led to an intensification of work on the use of living insecticides for the control of insect pests and, as a result of work done at the Laboratory of Insect Pathology of the Czechoslovak Academy of Science in Prague, it has been found possible to produce such a control, *viz. Bacillus thuringiensis*, by mass - production methods.

At the same time, research on various strains of the bacterium has been in progress in other countries also—in France, on methods for continuous multiplication; in Canada, on the mode of action of the protein component; in the U.S.A., on their toxicity and effectiveness against different pests; and in the U.S.S.R., their possible use against forest pests has been considered.

Deadly to caterpillars

The bacterium, *B. thuringiensis*, is deadly to moth caterpillars, as is confirmed by the mortality of the flour moth, *Ephestia kühniella*, in flour mills. Investigations have shown that the agent is self-sufficient and develops its own activator. The protein inclusions formed during the production of spores temporarily weaken the insect pest and permit the bacteria to penetrate from the intestine into the gut wall and the body cavity.

The spore material is hardy and the dry spores do not lose effectiveness even after six or seven years. Thus the insecticidal material may be stored and used over a period of time.

The problem that has remained has been the scarcity of spore material. Work over the past two years has accordingly been concentrated on the problem of the mass production of *B. thuringiensis*. Progress was not easy and had to be considered in stages, but it is now possible to produce the agent in kilogrammes and not merely, as formerly, in grammes, so that the living insecticide can be used in quantity.

Bacterial formulations

The insecticide has been produced as a 5% and 10% dust and as a liquid concentrate. Certain formulations will provide a uniform suspension of bacteria which, when sprayed, will spread evenly over the target. Other suspensions supply the bacteria in 'lethal doses', which when swallowed are sufficient to overcome the resistance of the caterpillar and cause its death. In calculating the number of spores from weight, one may assume that 1 g. of dry material contains 25.10^{10} spores.

Spores and inclusions of the microbe Bacillus thuringiensis

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An aerosol with Bacillus thuringiensis *in suspension being applied in the deciduous forests of South Moravia for the control of budworm larvae,* Cacoecia murinana. *A 95% mortality of the caterpillars resulted*

Test targets

A suitable target for the new preparation is the cabbage worm. Spraying with a suspension containing 80.10^6, a dilution of about 1 in 1,000, is effective; and cutworm (various *Noctuidae* larvae) and beetworm, *Hymenia recurvalis*, can be attacked similarly. It is quite safe to use it against the antler moth, *Cerapteryx*

graminis, as the grazing cattle give milk, unpolluted by insecticidal substances. Very good results have also been noted in tackling the brown-tail moth, *Euproctis chrysorrhoea*, and the gipsy moth, *Lymantria dispar*. In addition, the caterpillars of various leaf rollers in oaks and firs have been found to react rapidly to its application.

Mass-produced bacteria

It may be emphasised that the insecticide can be used for the direct spraying of the blossoms of fruit trees, and this opens the way to arresting the infestation of apples by the apple leaf roller—a world problem. The preparation represents, in fact, a mass-produced biological agent with very favourable properties. Prolonged trials have proved *B. thuringiensis* to be without toxic or pathogenic effect on humans and animals.

It is still necessary to explore the full range of application of this agent, and there will obviously be the question of increasing the scope of specialised strains of the bacteria to combat special cases of pest incidence. It might seem, perhaps, that the new insecticide introduces competition between biological and chemical preparations. This is not really the case, for all methods of attack have a place in plant protection—some have special advantages and serious disadvantages.

Pneumatic Harvesting

NEW advances in science and technology are making it possible to design pneumatic harvesters for a wide variety of crops. In the U.S.A. one firm[1] is marketing a pneumatic currant harvester which works rather like a vacuum cleaner.

This machine consists of a self-propelled framework which moves slowly along between the rows of bushes. A powerful fan sucks in air through a number of individual flexible vacuum tubes at the rear of the framework. Workers follow the machine on foot, guiding the ends of the tubes over the bushes to the bunches of currants. The fruit is sucked down the tubes into a chamber, from which any stray leaves are expelled. The fruit then slides down a chute and is crated immediately in boxes carried on the framework. Models with larger diameter tubes are available, so that the machine can be used to harvest grapes in the same way. Damage to the crop is said to be negligible.

In East Germany an idea has been formulated for harvesting sugar-beet[2] pneumatically. Two rigid metal feelers lift the beet tops upright and a share lifts the plants to another feeler, which guides the tops of the beet into the opening of a vertical metal duct, up which they are drawn by the suction produced from a powerful p.t.-o.-driven fan. The inner surface of the duct has rounded protuberances, against which the beet strike on their way up, knocking off any dirt still adhering to them. The beet are finally sucked to the topping unit, consisting of thin taut wires which cut off the tops. Beet and tops then pass on to separate hoppers.

In Georgia, U.S.S.R., the Kutaisi Agricultural Institute has developed a prototype pneumatic tea harvester[3] which has shown promise in field trials. In it a p.t.-o.-driven fan is fitted to a special high-clearance tractor, which straddles a row of tea bushes. As the unit passes along the row, air is drawn through a duct to which mouths of different sizes can be attached. The suction is sufficient to tear off the proper amount of leaf and convey it to a hopper on the tractor. Improvements still need to be made to the cushioning to prevent too much damage to the leaf.

Also, there are in Russia mechanical tea harvesters[4] which cut off the tea tips with special three-stage reciprocating blades and have pneumatic systems to suck the severed tips along a duct into a container. This is the only practicable way so far developed to recover the tips, and it has proved completely satisfactory in several seasons of work.

A pneumatic device has been developed by a firm in Illinois, U.S.A., to replace the conventional reel on combines.[5] A fan produces a constant delivery of air to a transverse tubular member rigidly mounted in the normal reel position. From this the air is fed to a series of jets positioned at the end of short lateral spacing tubes. The air blows the standing grain on to the cutter bar. This system is claimed to be quite as efficient as the ordinary reel, particularly in crops partly flattened by wind or rain.

These developments in pneumatic harvesting offer completely new possibilities of increased efficiency on account of fewer mechanical components and less wear, with lower first cost and economy in labour. The range of crops so far tried—currants, tea, sugar-beet, grapes and grain— is so wide and the technological resources now at our disposal so great that it seems quite likely that pneumatic systems can also be introduced for harvesting other types of farm produce.

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Cotton in Tanganyika

Film by Mercury Films of Nairobi, Kenya. 16mm., colour and sound. Apply to Manager, Lint and Seed Marketing Board, Pemba House, Dar es Salaam, East Africa.

This is the colourful story of cotton from first planting of the seed to when the bales of cotton are being shipped to cotton-consuming countries. It shows how research is contributing to quality, how its production is a 'family' concern and how the cotton is transported first as a head load by jungle path and across rivers and by lorry from the farms to the receiving depot.

Black Saxaul

W. LINNARD, M.A.

Black saxaul is a shrubby plant or tree which can be grown in sandy desert to provide both cattle fodder and fuel in such inhospitable regions. It may reach a height of 30 ft.

Black saxaul — an important fuel and fodder crop

IN connection with the Russian drive to increase livestock production, especially in the dry desert areas of the south-east of the U.S.S.R., afforestation with black saxaul seems to be a promising measure, combining as it does fodder and fuel production with desert reclamation.

Description

Black saxaul, *Haloxylon aphyllum*, is a large shrub or small tree which reaches heights of up to 30 ft. It has a dense crown 12-16 ft. in dia., which is a dazzling dark green in spring and summer and orange-brown in autumn. The stem is usually about 10 in. in dia. at the base, but individuals up to 3 ft. in dia. have been known. The bark is greyish-brown. The leaves are few and rudimentary, as befits a psammophyte,* and are mere protuberances about $\frac{1}{10}$ in. long.

Seedlings usually reach a height of about a foot in the first year. The shrub can coppice, and coppice shoots grow up to 3 ft. in a year. The tap root always goes straight down for some 3 ft. and then turns at right angles and grows horizontally for a further 3 ft. It then turns at right angles once more and goes down vertically either to the water table or to a moist soil horizon. In the first year the root may reach depths of between 3-7 ft.

For desert conditions

Because of its deep-rooting habit and low transpiration, black saxaul is well adapted to a desert environment. Its distribution covers much of Central Asia and the Middle East, from Jerusalem in the west almost to Dzungaria in the east, and from the Kara-Kum desert in the north almost to the Persian Gulf. It is principally found on lowlands with ground water at from 5 to 40 ft., in sandy or sandy loam deserts, sometimes on stony screes, and on dried-up watercourses and solonchak† soils. It is very resistant to sulphates, but less so to chlorides in the soil.

Korzhinski wrote in 1896: 'Thickets of saxaul can be compared neither with forests nor with shrub vegetation of the temperate belt. . . . They constitute a completely unique type of vegetation . . . ' Another Russian writer, Shnitnikov, wrote in 1925 of saxaul forest: 'In spite of its dense stand, it has a kind of luminous quality, due to the pale bark and the arrangement of the branches. . . . An awe-inspiring effect produced by the mass of dead saxaul lying about, which is dark in colour and has the oddest, most fantastic shapes'.

Provides feed and fuel

This dead wood lies in the stands for years without deterioration and is excellent fuel. Moreover, the saxaul provides grazing for sheep and camels throughout the year. Accordingly, it is not surprising that efforts have been made for some time to establish black saxaul in the desert and semi-desert areas in the south-east of the U.S.S.R., especially on takyrs and takyr-type soils. These takyrs are the flat-floored bottoms of undrained desert basins, similar to a salt pan and often covered with sand. They are almost entirely bare of vegetation and are put to no economic use. Takyrs cover very extensive areas in Soviet Central Asia and Kazakhstan, with 2,760,000 ha. in the Turkmen S.S.R. alone.

Method of reclamation

However, as no real data were available on the artificial establishment of black saxaul, the first attempts ended as failures. Only recently has a method been evolved by Lalymenko[1] which seems to make success reasonably certain, at least on takyrs not covered with sand. This method, developed at the Nebit-Dag Agricultural and Forest Improvement Experimental Station in the Trans-Caspian Kara-Kum, is as follows.

The first stage of the operation is done in the year before actual sowing. Contour furrows are cut across the main line of slope of the takyr surface, using a trenching plough which throws up the soil on both sides of the furrow. The distance between the centres of the furrows varies according to the different regions of Turkmenistan and the various types of takyrs. Four distances are set: 14.2, 16.6, 20 and 25 m. The wider distances are used when the surface clay-loam layer goes deeper

*Psammophyte: a plant which grows only on sand.

†Solonchak: arid, saline soil.

than 3 ft. and where the depth to moist soil horizons is greater than 12 ft. (4 m.).

The dimensions of the furrow, *i.e.* depth (BD) and width (AC) (see Fig. 1), vary with the distance between furrows, as shown in Table 1.

Table 1
Dimensions of furrows

Distance between furrows	*Depth of furrow*	*Width of furrow*
m.	*cm.*	*cm.*
14.2	25	70
16.6	30	80
20	35	90
25	40	100

These spacings and dimensions give total lengths and capacities of the furrow systems as shown in Table 2.

Table 2
Total length and capacity of furrows per ha.

Distance between furrows	*Length of furrows per ha.*	*Capacity of furrows per ha.*
m.	*linear m.*	*cu. m.*
14.2	700	60
16.6	600	70
20	500	78
25	400	80

These furrow capacities are sufficient (taking infiltration into account) to take the full volume of water occurring as surface run-off on 1 ha. of takyr under average conditions in the various parts of Turkmenistan. Immediately after this work has been done, a ditch system is dug at right angles to the furrows to lead surface run-off water into them. The water soaks into the soil, leaving it suitable for direct sowing.

Sowing

In the next January or February de-winged seed of black saxaul is sown in the furrows at a rate of about 1.3 kg./ha. (there are about 230,000 whole seeds and about 420,000 de-winged seeds per kg.).

As soon as the seeds have been sown the second stage of the operation is done (see Fig. 2): Another furrow of the same dimensions is cut about 2-2.5 m. from the seeded one. This second furrow is called the water storage furrow and the ditch system is then altered so as to divert further run-off from the seeded furrows to the water-storage furrows. The water-storage

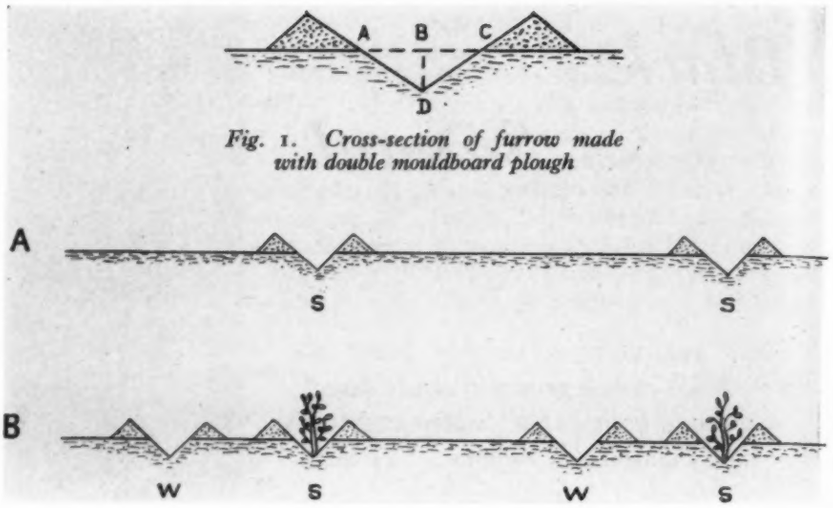

Fig. 1. Cross-section of furrow made with double mouldboard plough

Fig. 2. Cross-section of (A) the sowing furrows (s); and (B) with the water storage furrow (w) added

furrows must be dug because young saxaul plants cannot withstand complete submersion. The furrows with the trees gradually fill up with air-blown sand.

The only maintenance necessary for the plantation is the occasional cleaning out of the water-storage furrows, using the same drainage plough as was used to cut them.

Saxaul seedlings, so planted, may attain heights up to 4 ft. in one year, and mortality is not higher than about 40%, while in good years it is only 15%. No further losses occur in later years. At the end of the first year the plantation is thinned to consist of one plant per linear metre of furrow, or from 700 to 400 plants per ha., depending on the distance between the furrows.

Using this method, the Russians have high hopes of utilising some of the vast unproductive areas in Central Asia for camel and sheep fodder and for fuel production for the local population.

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Plastic Bags for Silage

A new method of storing silage and grain of high moisture content—in plastic bags—has been tested at the University of Missouri, U.S.A., and found to be satisfactory.

According to a recent issue of *Crops and Soils*, 100 lb. of maize, sorghum silage or high-moisture grain were packed into polyethylene tubing and then securely tied at each end so as to make an air-tight container. The bags were then stacked in the open for use in subsequent feeding trials.

These indicated that silage so made is highly palatable and readily consumed by livestock. Good fermentation is said to occur, with the desirable lactic acid being the predominant type formed. There was also satisfactory preservation of β-carotene, a substance which is converted to vitamin A in the animal. Other tests showed that high-moisture grain of milo sorghum could be stored in plastic quite as effectively as either dry or high-moisture milo grain stored in other ways.

The plastic bags have other advantages, for they allow the cattle feed industry to market silage and high-moisture grain in the same way as dry feed; the bags also provide farmers without silo facilities with a means of storing silage and for feeding their cattle without having to handle loose feed and the loss which that entails.

Legumes for Soil Conservation

D. G. CAMERON, B.SC., AGR.*

Soils, low in fertility, present many problems in stabilisation. Vigorous legumes are needed by the soil conservationist for the wide range of conditions which are encountered in the field.

Economic reclamation of this area and its future stability are dependent on the availability of a vigorous legume

THE major legumes used for soil conservation in the area under consideration were subterranean clover (which is the premier soil conservation legume), lucerne and barrel medic, and their major role is to rebuild the fertility of the eroded area so that it is capable of supporting a suitable soil stabilising perennial grass. These plants themselves also contribute considerably to soil protection at certain times of the year, but all have some disadvantages in this direction, and legumes that provide more satisfactory surface protection would prove of value.

The relative areas of usefulness of the major soil conservation legumes are, as yet, not fully understood, especially the boundaries of the zones in which the various sub-clovers are of value.

Several annual clovers have, however, shown promise of value in areas where the sub-clovers may not persist, rose clover and globe clover in particular showing this promise, due possibly to an ability to set higher levels of hard seed under the harsher conditions that will be experienced in these marginal areas. A more widespread collection of annual clovers has now been obtained in the hope of finding other lines of this type that do not have the poor winter growth of these two species.

The compact crown, which is characteristic of lucerne, is a major drawback, but the creeping-rooted and rhizomatous types that have recently been developed overseas offer a means of overcoming this problem and a start has been made by C.S.I.R.O. geneticists to study this aspect in Australia. When available, this material should prove of considerable assistance to the soil conservationist.

A number of summer-growing legumes have been studied in the hope of obtaining alternate species for use in the northern sections of the State.

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Left: *The* Glycine javanica *nursery row. Scone Research Station,* 1954. Right: Trifolium spumosum (left) *and* T. globusum (right) *in eight link-spaced nursery rows at Corra Research Station, November* 1956

A nursery row of Sulla, Hedyasarium coranium, *at Inverell in September* 1957

Of these, it has generally been noticed that the tropical and sub-tropical legumes are out of their element this far south, the growing season being too short, rainfall too low and frost too severe for persistence. There are a few, however, such as *Glycine javanica* and *Dolichos lablab*, that appear adapted, though whether summer rains will prove reliable enough to make their sowing worthwhile remains to be seen.

It is noticeable that the summer legumes lespedeza and kudzu, which have received such popular acclaim as conservation legumes in the southern States of the U.S.A., are out of their element here, although the annual Korean lespedeza may be useful on lighter-textured and acid soil in the northern portion of the zone under consideration. The other lespedezas and kudzu may, however, have some uses under the higher rainfall conditions of the north coast.

One point that should be borne in mind when considering these results is that of nodulation. It is possible that some of the species under test have not been adequately nodulated. All legumes on sowing have been inoculated with a rhizobium culture, but frequently it has not been possible to guarantee that the particular culture used has been an effective one for that particular species and some, at least, of the poor performances of the summer species may be due to this factor.

Conclusions

A wide range of legumes, both annual and perennial and both summer and winter growing, have been examined with the object of isolating improved lines for use by the soil conservationist within the sections of New South Wales indicated.

No plants greatly superior to the standard species—subterranean clover, barrel medic and lucerne—have yet been identified, but a number of lines have been seen which may have limited uses and are worth further study. They include *Trifolium globosum*, *T. hirtum* and Dixie strain of crimson clover in the annual clover group, and *Glycine javanica*, *Dolochos lablab*, *Phaseolus lathyroides* and *Lespedeza stipulacea* amongst the summer-growing species.

Abridged version of an article in the Journal of the Soil Conservation Service of N.S.W., 1958, 14 No. 4.

European Weed Research Council

The International Research Group on Weed Control met in Lincoln College, Oxford, early this year to consider its future plans.

It was agreed that continued co-operation between European weed research workers was desirable and the creation of a European Weed Research Council was approved. The Council was elected with the following officers: Professor B. Rademacher (Germany), President; Dr. R. Longchamp (France), Vice-President; Dr. W. van der Zweep (Netherlands), Secretary-Treasurer; J. D. Fryer (England), Editor. The Council is completed by one member from each of the interested European countries so far—Austria, Belgium, Denmark, Finland, France, Federal German Republic, German Democratic Republic, Great Britain, Italy, Ireland, Netherlands, Norway, Portugal, Sweden, Switzerland, Turkey.

The Council has decided to publish a scientific periodical on weeds and their control, entitled *The Journal of Weed Research*, which will be edited by Mr. J. D. Fryer, with Professor B. Rademacher and Dr. R. Longchamp as Assistant Editors. The first issue of the journal is scheduled to appear in January 1961. Papers will be accepted if written in English, French or German provided an adequate summary is presented in the other two languages.

Any communications should be addressed to the Secretary-Treasurer, Dr. W. van der Zweep, European Weed Research Council, P.O. Box 14, Wageningen, Netherlands.

Solar Heat

The distillation of salt water by solar energy is being investigated in Florida by the U.S. Department of Interior. The object is to produce fresh water from sea water at a cost less than $1 per 1,000 gal. In desert areas, where high prices are paid for fresh water, and on small islands in the Pacific Ocean where the inhabitants are dependent on rain water for their supplies, distilling sea water by solar energy may provide the answer.

A Tree Bicycle

A 'tree-bicycle', designed for climbing up the clear stems of pine and fir trees with ease and safety for the collection of cones, was demonstrated during a Course on Seed Collection, recently held at the Alice Holt Lodge —the U.K. Forest Research Station.

Handling of Watercress

The wilting of green-leaf vegetables in transit between grower and consumer is a serious matter and can render a consignment worthless. This account will be of interest to large producers of green-leaf vegetables in countries with a dry, hot climate.

A part of the reception shed, where the watercress is washed, trimmed, bunched and placed in baskets

BECAUSE of its highly perishable nature, watercress, *Nasturtium officinale*, suffers more wastage during transit between grower and consumer than other leaf vegetables, particularly during the warmer months, when the crop quickly wilts, loses colour and becomes unsaleable. To reduce this wastage and ensure that the product arrives at its destination in a fresh condition, refrigeration and hydro-cooling are being introduced at the reception station.

At a new watercress packing station at Alresford in Hampshire, England, the plant operates on a continuous flow principle, the units being linked by roller conveyors. These include equipment for lifting the cooled produce from the water and a cold room for storage.

Processing the product

The watercress, grown in artesian water in fields which are carefully laid out to give the correct fall, is gathered and placed in baskets and transported to the packing and processing shed.

After being washed, trimmed, bunched and packed into baskets, the watercress is placed on an inclined conveyor, which takes it through a trap hatch into the cooling section. An operator places the tops on the baskets and transfers them to a further conveyor, where they slide by gravity into the hydro-cooling tank.

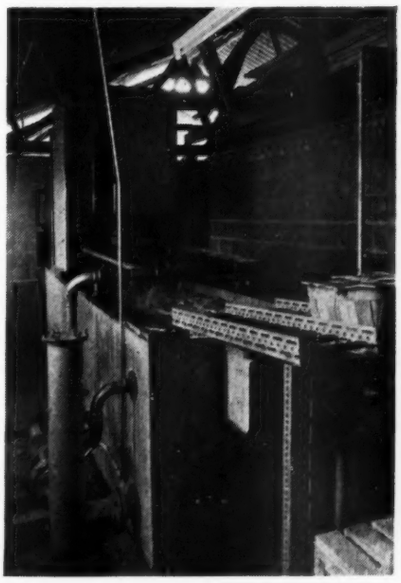
This is an open-top tank with a horizontal baffle separating the top from the bottom. Cooling is by the 'ice-bank' principle, incorporating a *York* 1½-h.p. 'Refrigerant 12' condensing unit, the coils being located in the lower section. Water is drawn from this lower section by a 1-h.p. *Worthington Simpson* 'Monobloc' centrifugal pump and discharged through sprays directly on to the baskets of watercress floating beneath. The water is returned for re-cooling through removable fine-mesh screens.

The baskets pass on down the tank three abreast, guided by rails and propelled by the water jets. When they reach the end of the tank they are lifted out by a power-operated elevator, by *Scott & Scott (Bournemouth) Ltd.*, and mechanically assisted down a roller conveyor into the cold store.

In designing the cold store, consideration had to be given to the respiration of the watercress and, since watercress will dehydrate rapidly, a high rate of humidity has to be maintained.

Although the room was not larger than 900 cu. ft., two unit coolers were installed across the width of the room to reduce air velocity to a minimum. Standard *York* R5F ceiling-mounted, forced-draught type coolers were used, connected to a 'Yorkometic' sealed type condensing unit.

The cold store was insulated with 4 in. polystyrene on the walls and 4 in. cork on the floor. It was finished internally and externally with galvanised steel sheet. Unloading was through a hatch to a vehicle outside, final delivery being made by train to markets in various parts of Britain.



Closed baskets passing into the hydro-cooler to the mechanical lifter at the end of the tank. To the left is seen the York 1½-h.p. condensing unit

Coming Events

Packaging.—The Fresh Food Packaging Exhibition will be held at Alexandra Palace, London, from 1-4 November. Particulars from Brooks Publicity Services, 6 London Street, Paddington, London, W.2.

A National Packaging Exhibition also takes place in Toronto, Canada, from 1-3 November. Particulars from Packaging Association of Canada, 1835 Yonge Street, Toronto 7.

Weed Control.—The 5th British Weed Control Conference will be held in Brighton from 7-10 November. The main session will cover the following subjects: Impact of Herbicides on Crop Husbandry; Weed Control in Arable Crops; Improvement on Pastures and Hill Grazing—Bracken Control; Problems of Advice and Education; Weed Control in Horticultural Crops; New Herbicides; Weeds of Waterways; New Techniques in Agriculture and Horticulture; Translocation and Fate of Herbicides in Plants. Information and registration forms from the Secretary, British Weed Control Conference, 52 Bedford Row, London, W.C.1.

The North Central Weed Control Conference will hold its annual meeting in Milwaukee, Wisconsin, U.S.A., from 12-14 December.

Corrosion and Metal Finishing.—The 1960 Exhibition will take place at Olympia, London, from Tuesday, 29 November, to Friday, 2 December.

Full information is available from the Organiser, *Corrosion Technology*, Leonard Hill House, Eden Street, London, N.W.1.

Agronomy.—The American Society of Agronomy, the Crop Science Society of America and the Soil Science Society of America will hold their annual meeting in Chicago, Illinois, U.S.A., from 5-9 December. Enquiries should be sent to the American Society of Agronomy, 2702 Monroe Street, Maidson 5, Wisconsin, U.S.A.

Hybrid Maize.—The Hybrid Maize Industry Research Conference will be held in Chicago, Illinois, on 7 and 8 December.

Refrigeration and Air-Conditioning.—The International Refrigeration and Air-Conditioning Exhibition is to be held at Earls Court, London, from 11-14 April, 1961. Details may be obtained from Patrick Smyth, 1 Crane Court, Fleet Street, London, E.C.4.

Agricultural Exhibitions

Canada.—The Royal Agricultural Winter Fair will take place in Toronto from 11-19 November. Details from J. R. Johnson, Royal Coliseum Exhibition Park, Toronto 28.

The Canada Farm and Industrial Equipment Trade Show will be held in Toronto from 25-28 January, 1961. Information from the Exhibition Organisers, 40 Wellesley Street E., Toronto 5.

England.—The Smithfield Show and Agricultural Machinery Exhibition will be held at Earls Court, London, from 5-9 December. Particulars may be obtained from Smithfield Show Joint Committee, Forbes House, Halkin Street, London, S.W.1.

Germany. — The annual 'Green Week' International Agricultural Exhibition will be held from 27 January-5 February. Enquiries should be addressed to Berliner Ausstellungen Eigenbetrieb von Berlin, Berlin Charlottenburg 9, Masurenallee 5-15.

Belgium.—The 41st International Agriculture and Agricultural Machinery Exhibition will be held in Brussels from 12-19 February. Details from Salon de l'Agriculture, 29 rue de Spa, Brussels.

France.—The International Agricultural Machinery Exhibition will be held in Paris from 7-12 March. Particulars from the Salon International de la Machine Agricole, 95 rue Saint-Lazare, Paris 9e.

Italy.—The International Agricultural and Animal Farming Fair will be held in Verona from 12-20 March. Further details may be obtained from Secretary-General, International Agricultural Fair, Palazzo del Pallone, Verona.

South Africa.—The Rand Easter Show will be held from 21 March-3 April. Enquiries should be sent to the Witwatersrand Agricultural Society, P.O. Box 4344, Johannesburg.

Egypt.—A World Agricultural Exhibition will be held in Cairo from 15 February-30 March. Details from the Exhibition Committee, Central Ministry of Agriculture, Cairo.

Circular Nurseries

In recent years, foresters in Poland and Czechoslovakia have been experimenting with forest nurseries of a new shape inside the forests. Instead of the usual square or rectangular plots, nurseries have been made by clearing a circular strip within the forest with a circular 'island' of forest in the centre. The central island is usually about 30 yd. in dia., and the nursery ring is about 20 yd. wide. These dimensions can be varied according to the height of the surrounding trees. Radial and circumferential paths can be laid out in the nursery.

Such small, circular, intra-forest nurseries have several advantages over large conventional nurseries situated outside the forest. Thus, the plants are grown in an optimum forest environment, which includes the presence of mycorrhizal fungi. The surrounding trees and the central island provide adequate shelter from wind, and also good natural conditions of light and shade, the light-demanding tree species being raised in the sunnier parts of the nursery. The circular ring design allows the use of mechanical implements with longer runs than with the compact square or rectangular nurseries. Such nurseries can be located close to the site where the seedlings are to be planted, with a consequent saving in transport costs and plant mortality.

Excellent results from these nurseries have been reported for a wide variety of plants.

Lawrence McMillan, World Ploughing Champion of 1959, with his Fordson 'Power Major' tractor and Ransome plough

Thoughts on Competition Ploughing

W. L. McMILLAN*

APART from the pleasure and excitement they give to entrants and spectators alike, ploughing competitions serve a very useful purpose in setting and maintaining ploughing standards. Many of the hints are well known to skilled ploughmen, but it is hoped that among them something will be found helpful to experts and beginners alike.

The author of this article became Champion Ploughman of the World in the competition held in Armoy, Northern Ireland, last year. The hints which he gives will be of assistance, not only to competitors in ploughing contests, but also to anyone who uses the mouldboard plough.

Preparation of the plough

1. All earth-wearing parts must be highly polished and not allowed to rust at any time. At night the plough should not be left with the bodies in the soil; they should be cleaned and covered with oil or grease.

2. Disk bearings should be sufficiently tight to enable the disks to revolve truly.

3. Skim coulters or attachments must be easily adjustable.

4. All nuts on the plough must be tightened and it will eliminate much frustration if those parts which have to be loosened during the course of plough setting are well oiled and free from paint.

5. The plough alignment should be checked and new shares and wings should be fitted where necessary so that there is no variation due to normal wear and tear.

6. It is important that all adjusting screws should turn easily.

7. Naturally the appearance of the tractor and plough should be smart and workmanlike, for a plough that is well painted and shining is a satisfying sight as it cleaves the soil, giving confidence to the operator and pleasure to the spectators.

8. Three straight wooden poles are necessary for use as sighting poles when making openings. These should be at least 5 ft., but not more than 6 ft. in height.

9. The tractor wheel setting should be correct for the width of ploughing, *e.g.* for 10-in. furrows, 56-in. wheel centres, with the centre of the front wheels tracking with the centre of the rear wheels.

10. The upper link and levelling box on the tractor must be easily moved.

11. A straight-edge, a 3-ft. rule and a long tape line are essentials for the pocket of the ploughman at all competitions.

Plough alignment (Hint 5)

The plough should be placed on a level surface and adjusted so that the beams are level with the floor. The illustration (Fig. 1) shows a long straight-edge being placed alongside the rear body so that it touches the share point on the heel of the slade.

* Farmer of Fairview, Dundonald, Belfast. Northern Ireland Ploughing Champion 1955-58; World Champion 1959; has competed in 180 competitions.

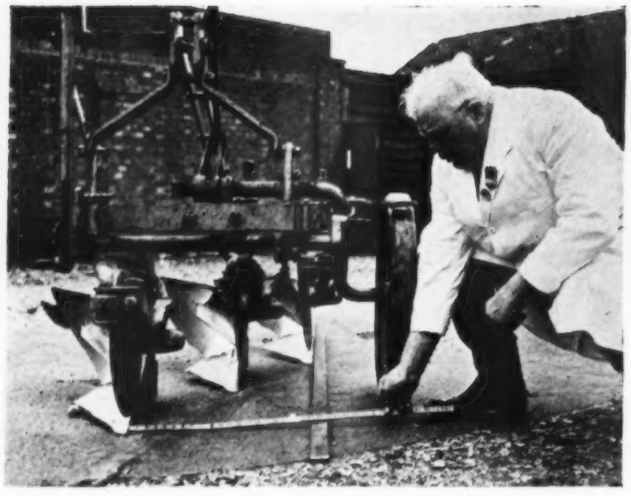


Fig. 1. Testing the furrow widths, using a straight-edge and rule

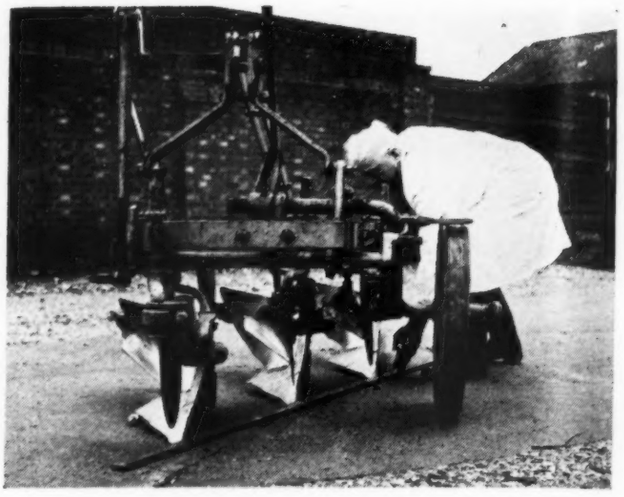


Fig. 2. Testing point alignment with a straight-edge

Measurements can then be taken from the inside of the straight-edge to the inside of a straight-edge, similarly placed against the share of the body in front of the rear one. This measurement should be equal to the furrow width on the beams of the plough.

Similar measurements can then be taken relative to the other bodies and these will be found to be double in the case of two bodies forward, and so on, but each body must be treated individually. A straight-edge is placed alongside the share points to touch each share point (Fig. 2).

Operating hints

Usually there are a number of furrows to be ploughed round the opening before starting to plough against the adjoining competitor's work. If these furrows are not finished in time, it means that your opponent can needlessly be held up. This, naturally, could lead to much ill feeling.

1. The secret of success is to arrive at the plot in good time, get the opening poles set properly, having first found out from the match committee which side of the marking pins they should be set. The type of opening to be made should also be known, *i.e.* whether the first furrows have to be opened out and closed in, or whether one small chip or furrow is to be ploughed in and covered. The heavy opening furrows must be sized to look the same as the following furrows.

2. Always plough straight. If this is carried out daily, it becomes a habit. Straight ploughing often covers faults which are more easily spotted in twisted work.

3. Before starting to split against the neighbour's work, the plot to be ploughed should be measured and any discrepancy should be put right against the neighbour's plot. This should be done in a workmanlike manner so that not only your own plot but also the neighbour's plot is not spoiled.

4. Attention should always be paid to making neat 'outs' and 'ins' on the headlands. Points are usually awarded for this aspect of the work, and if two competitors have equal points for their plots, but one has better 'outs' and 'ins' than the other, these could make all the difference.

5. Furrows must be turned and surface vegetation buried. Rules usually debar any handling of furrows, so that mistakes once made cannot be corrected. However, if rules allow correction by hand or foot, these should be corrected before other furrows are turned against them.

6. When the plough is set properly and all operating parts are working correctly in unison, the furrow slices will be packed tightly. Firmness is essential to withstand variable weather conditions.

7. Ploughing should be done at a steady pace; it is better to maintain this, rather than move too slowly at the start and rush at high speed at the finish in order to complete the plot in the allotted time.

8. A final width check should be made to the plot before coming to the finish.

9. It is important to bring each land to finish with straight and parallel sides. When all four wheels run in the furrows the tractor should be driven with the nearside front wheel against the furrow wall. This ensures a regular unploughed strip. The aim should be to work the area down to two furrows with a three-furrow plough and one furrow with a two-furrow plough. The finish is then completed by using the front body or bodies with the rear one ploughing up an earth furrow. The latter will reduce the width of the finish and also provide the rear body with an anchor to counteract the mouldboard pressure on the front body or bodies when turning the last furrow slice or slices.

10. The wheel mark on the ploughing should always be shown on the neighbour's side of your plot.

A final word

The importance of practice, of course, cannot be overstressed. Practise as often as possible on as wide a variety of soils and conditions as can be found.

It is vital to find out the setting of all parts on the plough to meet the rules of the competition, and the rules should be studied most carefully. Points can be lost and disqualifications made because a competitor has not read his rules properly.

The most important rule is the one concerning time—always make the most of the time allotted. This can only be learned by experience after many matches under varied soil conditions and by knowing what adjustments are essential as a result of such experience.

The Role of Potassium in the Nutrition of the Oil Palm

G. GRUNER, DR.AGR.

In the past two decades extensive knowledge of the nutrition of this important economic crop has been gained from numerous investigations in the chief oil palm-growing regions, viz. *West Africa, Congo, Malaya and Indonesia. The results of this work allow conclusions to be made not only regarding the requirements of the oil palm for individual nutrients, but also on the optimal nutrient ratio for prevailing conditions.*

INCREASING attention was given to potassium after orange spot disease in Nigeria and Malaya was identified as being due to a deficiency of this plant nutrient. The first symptoms of this disease—with which is associated severe loss of yield—consist of clearly separated orange-coloured spots on the pinnae of the older fronds; subsequently these spots expand into irregular shapes and increase in numbers, especially along the leaf veins. In place of chlorotically-faded areas of leaf, necrosis often develops with *Pestalozzia palmarum* or grey blight as a secondary effect. Progressive leaf necrosis leads finally to the decay of the leaves. Up to a certain stage, recovery of the palms affected and a crop increase of up to 300% may be achieved by timely treatment with potassium.

Potassium deficiency symptoms can be distinguished very definitely from the damaged appearance caused by magnesium deficiency, *viz.* a streaky yellowing of the leaves that begins from the leaf tips or from the leaf margin. It should be noted in this connection that under the conditions of the Congo another symptom—a white chlorotic streaking—is associated with potassium deficiency.

In Nigeria, moreover, control of vascular wilt disease caused by *Fusarium oxysporum* may be obtained by the application of potassium.

Potassium status of soils

The potassium deficiency found in oil palm-growing areas is not restricted to certain geographical regions. In a pronounced form it occurs chiefly on sandy or gravelly sedimentary soils and is associated with high rainfall. In the drier areas of its cultivation the soil use before the establishment of a plantation is decisive for the potassium content.

The intensive cultivation of fruits and food crops before planting will usually result in deficiency symptoms in the palms. On the other hand, potassium deficiency is also found, though to a lesser extent, on basement complex soils and on recent clearings of virgin forest.

Photo: Prof. Dr. De Bussy, KON.INST.V.D. Tropen, Amsterdam

Inflorescences of an oil palm

Analytical techniques

Indications of potassium status can be obtained by soil analysis and foliar diagnosis, provided that the limited range of application of both methods is appreciated. Investigations have clearly shown that the availability of this element depends less on the absolute content of the individual nutrients in the soil, or in the plant, and more on the relative proportions of the individual nutrients.

The methods of soil analysis can be applied with advantage in mature, well-managed plantations. Oil palm plantations of this kind usually form a relatively stable natural economy, for the uppermost soil layer is not only a carrier for the nutrients contained in the soil, but, at the same time, it is also a reservoir for the nutrients returning through leaf-fall. On account

Photo: Landesbildstelle, Hannover

Fruit bunches of oil palm in Java

of the very extensive superficial root mat of the oil palm, therefore, apart from nutrient removal by the harvest of the fruit bunches, the nutrient cycle is almost a closed system.

The 'mole fraction' of available or exchangeable potassium in the top 6-in. soil layer is a useful value for judging the potassium requirement. It is synonymous with the proportion of potassium in the cation-exchange capacity—the K/T value. On acid sandy soils in Nigeria values between 0.015 and 0.01 gave a moderate effect, while below 0.01 a strong potassium effect could be established. It appears quite possible that these values may have equal validity under other soil conditions.

The connections between individual elements with respect to the yield levels of the oil palm are more clearly apparent in the interpretation of the results from leaf analysis. It appears that occasionally there are close limits for 'optimal concentrations' of a nutrient in the leaf tissue and only a narrowly limited 'optimal leaf composition' with regard to the individual elements, irrespective of the kind of soil.

With correct sampling and the appropriate analytical technique comparable analytical values may be determined even for the most varied plantations and conclusions reached on their nutrient requirements. Of course, the difficulties of analysis are increased, for usually it is not sufficient merely to determine the content of potash, phosphorus, calcium and magnesium in the leaf tissue. In order to be able to decide unambiguously whether the lower or higher value of a nutrient in the leaf tissue is not caused by lack or excess of another element, it has been found to be occasionally necessary to extend leaf analysis to include the elements nitrogen, sulphur, manganese, boron, copper and zinc.

Interactions between nutrients

With reference to inter-relations between individual nutrients, there could be observed a certain K/Ca and K/P 'antagonism'. The optimal ratio of K_2O/P_2O_5 is between 2.5 and 3.5. Below the value 2.5, application of potassium produces a good response, but not the application of phosphoric acid; above the value 3.5 only with phosphoric acid can any effect on yield be obtained.

In the Congo, connections between the content of the nutrients potassium, calcium and magnesium in the leaves were found. For an optimal composition with respect to growth and crop yield, of the sum of the three cations—which should amount to about 2.7% of the dry weight—determined by leaf analysis, the proportion of each should be: 67-70% of K; 19-24% of Ca; and 10-13% of Mg.

Deviations from these limiting values were found only in plantations of rather low productivity as well as in badly growing new plantings. The values given agree with the following content figures, expressed in ash percentages: K, 25-28%; Ca, 7-9%; and Mg, 3.7-4.8%. Expressed as dry matter, these values amount to: K, 1.7-1.9%; Ca, 0.55-0.65%; and Mg, 0.25-0.35%. The samples for these leaf analyses were taken on each occasion from the pinnae of the youngest fully-opened leaf.

In Dahomey and on the Ivory Coast, fertiliser treatment with any particular nutrient is recommended only on reaching a definite critical value. For potassium this is at 1.38% of the dry matter. In Malaya the threshold value for K lies at 1.0% of the dry matter; this is based on the analysis of a leaf sample from the 17th frond.

Need for field trials

Foliar analysis alone gives information only about the nutrients limiting growth and production; it does not permit any conclusions regarding the nutrient reserves in the soil. Also soil investigation for the determination of the necessary amounts of fertilisers is even less suitable. The setting up of

Photo: Inst. Rech. Huiles Oléagineux, Paris

To keep oil palms healthy and productive mineral fertilisers are indispensable. The above pictures show the K_0 and the K-plots of a potash fertiliser experiment at Dabou, Ivory Coast, and the improvement in the foliage resulting from an annual dressing of 1 kg. muriate of potash per palm

fertiliser trials with different doses of K_2O cannot be avoided in determining the 'optimal' amount of potassium necessary. The effect of these fertiliser doses on the results of leaf analysis—apart from the yield differences obtained — will indicate whether the amounts of potassium were measured correctly.

The annual removal of potassium can give an approximate idea of the size of dose of this nutrient to be selected. In the case of an harvest of 13,400 lb. of fruit bunches per ha. in Sumatra, the nutrient removal was estimated to be 120 lb. K_2O per acre annually. With higher yields, the potassium removal by the annual harvest went up to 218 lb. K_2O per acre. Over a period of 16 years the average potassium removal from an oil palm plantation in Nigeria, established on a clearing of a high secondary forest, amounted to 250 lb. K_2O per acre.

In the measurement of the dose of potassium soil type plays an important role in so far as considerable losses through leaching have to be considered on sedimentary soils with the high rainfall usual in oil palm-growing districts. On heavy clay soils, on the other hand, the losses through leaching will be distinctly smaller.

In an experiment on sedimentary soils in Nigeria with increasing potassium, in which 336 lb. K_2O per acre and 672 lb. K_2O per acre were applied, yields of 42,570 lb. per acre on the K_1 plot and 43,288 lb. per acre on the K_2 plot of fruit bunches were obtained. In contrast, the crop on the K_0 plot was only 23,601 lb. per acre.

Doses to be recommended in the case of young oil palms, planted at 60 palms to the acre, have been found to be 3.5-7.0 oz. K_2O per palm in addition to 1.8-3.5 oz. N and 3.2-5.5 oz. P_2O_5. For bearing palms with the same density of planting, 11-22 oz. K_2O are recommended, besides 2.7-5.5 oz. N and 3.2-6.5 oz. P_2O_5 per palm.

These recommendations correspond in the case of young palms to 15-30 K_2O, 10-15 N and 15-30 P_2O_5 in kg. per ha. or lb. per acre respectively. With bearing palms the fertiliser doses run to the following nutrient units in kg. per ha. or lb. per acre respectively: N, 10-20; P_2O_5, 15-30; K_2O, 50-100.

Forms of potassium

For fertilising, potassium sulphate, potassium chloride and potassium magnesium sulphate (Patent Kali) are suitable forms of potassium. In experiments in Indonesia, however, potassium sulphate gave better results than potassium chloride in terms of oil yield per unit area. This phenomenon is not due to a Cl-sensitivity of the oil palm, but rather to the good influence of the SO_4-ion on oil formation. On soils which show magnesium deficiency the application of potassium magnesium sulphate is particularly recommended.

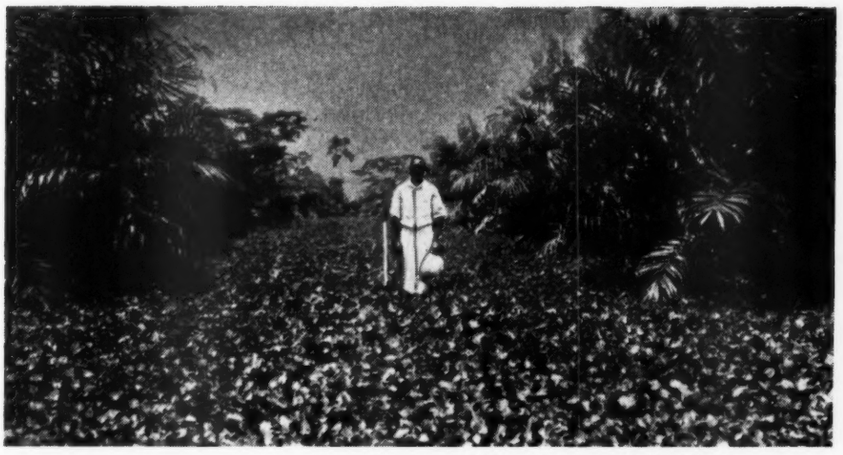


Photo: Inst. Rech. Huiles Oléagineux, Paris

Oil palms demand a soil of high humus content. Inter-cultivation with a green manure crop will protect the soil and supply it with organic matter

Fertiliser placement

With regard to placement, no advantage could be found in bearing plantations from a ring-like application around the trunk as against a uniformly broadcast distribution of fertiliser over the surface.

In the Congo, however, in young plantings, growth improvement has been observed with ring placement. Accordingly a ring-like placing within the diameter of the crown in the case of one-year-old trees and ring placement somewhat outside the tree canopy in the case of two- to four-year-old trees appears to be desirable.

These preferences appear to be correlated with the formation of the root system. Morphological studies show that in the early development of the palm a thick root zone at a distance of 12 in. (30 cm.) around the stem is first formed; later a second root zone extends somewhat beyond the area covered by the tree canopy until finally, by a subsequent branching of the side roots, a thick superficial root mat develops in place of the distinct root zones.

More Rice for Fiji

In Fiji close on 35,000 acres of rice are grown each year, producing a crop worth £1 million. Nevertheless, the Department of Agriculture estimates that in the next five years a 50% increase in the acreage will be needed to feed the growing population. To keep pace with subsequent population increase a further 3½-4% per year will be needed.

The Department is giving rice growers active practical assistance in the growing, harvesting and selling of their crops. Over 8,000 acres have been planted, the expected yield being around 7,000 tons.

A new rice mill is being built. Under the proposed buying system, farmers will collect 60% of the value of their crop as soon as it is weighed. If among them the farmers produce 3,000 tons or more of rice, they will be paid an extra £1 per ton (see also WORLD CROPS, 1960, **12**, 171).

Letters to the Editor

Rubber in Dominican Republic

Sir,—With reference to 'A Reader's Reactions'* which appeared in WORLD CROPS, May 1960, **12**, 186, our rubber expert, Mr. J. Werkhoven, would like to make the following observations:

'As a matter of course we, too, were very interested in your article published in WORLD CROPS, December 1959, **11**, 428, dealing with rubber cultivation in the Dominican Republic, and consequently we produced an abstract of it in the April issue of our monthly "Tropical Abstracts", pages 232/3.

'Like reader Veersema, we, too, were struck by the extremely high estimate of yield claimed for rubber in the Dominican Republic, viz. 3,000 lb. of dry rubber per acre per year, a figure we think can hardly be correct.

'In our opinion such a high level of production cannot be reached in commercial rubber plantations under Dominican conditions on account of the production capacity of the planting material in question consisting of Sumatra and Java clones (GA 1094 and 1026 are unknown to us; presumably are meant GA 1191 and 1126). The best of the clones mentioned (GA 1191 and 1279) are yielding up to 2,000 lb. per acre under the most favourable conditions of Sumatra, whilst the other ones are not exceeding the 1,500 lb. level.

'Since the common high-yielding Far Eastern clones are too risky (with a view to the South American leaf blight, even under Dominican conditions) and the blight-resistant South American material is still of limited and rather unknown production capacity, blight-tolerant clones such as GA 1126, 1279 and 1301 may be regarded as suitable material for Dominican conditions. It may be noted that GA 352 is extremely liable to wind damage. For small farmers, seedling plantations are much easier to establish than budded plantings.

'Used as clonal seedlings, however, the material should be planted densely to enable rigorous thinning out. In our opinion the optimum density for mature commercial plantations under Dominican conditions will be about the same as in the Far East. The material in question may yield at most 1,250 lb. of dry rubber per acre per annum in normal plantings in the Dominican Republic; when hedge-planted—a farmer's type of rubber production combined with intercropping—an average yield of 1,000 lb. per acre may be regarded as a favourable result'.

IR. M. VAN BOTTENBURG.
p.p. Royal Tropical Institute,
Amsterdam.

*No reply has yet been received from Dominican Republic in answer to Mr. Veersema's letter—Ed.

Copyright in Plants

Sir,—It is to be hoped that Parliament will not long delay implementing the excellent recommendations of the Committee on Transactions in Seeds, which would guarantee plant breeders' patent rights for new varieties.

Their adoption would undoubtedly give a tremendous boost to private plant breeding in Britain, hastening discovery of new improved varieties. I need only mention that the recent introduction of a new type of Dutch spring oats, 'Condor', has given increased yields by 10% generally throughout the country, to show the value of new varieties. Without doubt this will become one of the most widely grown oats in Britain, but it might never have been sown here but for a private 'royalty' arrangement, similar to that now officially recommended.

Breeders, both British and European, have in the past been naturally unwilling to share their discoveries for fear of 'piracy'. The proposed legislation would scotch these fears. It would also enable breeders to devote more money to research, the outcome of which would benefit the entire community in the form of increased home production of cereals.

JOSEPH NICKERSON.
Rothwell House,
Lincoln.

Timber for Agricultural Buildings

Sir,—The article by Dr. W. P. K. Findlay in your July issue will be of considerable interest to farmers throughout the world. I would, however, like to comment on three points which might be misinterpreted.

If timbers, after cutting to size, are steeped in strong aqueous solutions of borax-boric acid or sodium pentachlorophenate, there is a danger that they will change their dimensions, and on drying may not necessarily return to their original size and—particularly in hot climates—may develop shakes or splits. For dipping or steeping timbers cut to size and shape, tar oil and solvent-type preservatives are more suitable products, as they do not cause warping and shrinking etc., and water-repellent, solvent-type preservatives can in fact retard dimensional changes due to variations in atmospheric moisture.

Brushing is the only method of applying such solvent-type preservatives and, as Dr. Findlay rightly points out, they may fail to give adequate protection if insufficient preservative is absorbed by the timber. Tar oil and water-borne preservatives may also fail if applied by brushing to timber exposed to severe insect or fungus attack. Solvent-type preservatives, however, are also applied by dipping, steeping, the hot-and-cold process, and pressure impregnation, the recommended method of application being related to the conditions in which the timber will be used and the hazards to which it will be exposed.

The cost of solvent-type preservatives is not necessarily exceptionally high in the less highly industrialised countries. At least one solvent-type preservative is available in concentrated form for export, and petroleum oils suitable for diluting it are reasonably priced and readily available throughout the world.

D. BOOCOCK.
Technical Director,
Preservation Developments Ltd.

New Publications

Grasses in Agriculture

By R. O. Whyte, T. R. G. Moir and J. P. Cooper. Pp. 410. FAO Agricultural Studies No. 42. FAO, Rome, Italy, 1959. Price $4 or 20s.

This publication by FAO is a companion to the earlier book on 'Legumes in Agriculture' and its joint authors are to be congratulated on the way in which they have presented so much information in 410 pages.

There are three major parts. The first, dealing with the agronomy of grasses, constitutes over half the book. It begins with a consideration of the practical factors governing grassland farming, particularly in relation to limitations imposed by economic and physical conditions. This is followed by a chapter dealing with the use of grassland for maintaining soil fertility. The practical considerations concerning soil fertility will vary with farming systems and local climate, and this is recognised by the authors in considering the role of grassland in maintaining soil fertility in relation to the major geographical regions of the world.

The agronomic factors involved in herbage production are dealt with at length and include the preparation of seedbeds, establishment of swards, management for grazing and cutting, the influence of organic and inorganic nutrients on plant growth and the use of irrigation. There is a brief report on the improvement of permanent pasture, but little reference to the use of herbicides. It is to be hoped that there will be future editions and that room will be found to include this topic, particularly in relation to the use of herbicides for improving permanent pastures without ploughing.

There is an interesting chapter on the feeding value of herbage in the tropics. It is a pity that this is not balanced with a chapter on the efficient utilisation of grass in temperate regions, together with the allied problems of digestibility and nutritive value. The production and distribution of seed is discussed and the description of various seed certification schemes is useful because of the necessity to ensure supplies of good-quality herbage seed throughout all grass-growing areas. There is also a short but valuable section on experimental methods, a description of plant introduction and testing methods, and some simple experimental designs for field trials.

The second part of the book is more fundamental and deals with the biology of grasses. The physical factors affecting growth and the response of grass to grazing and cutting are dealt with in detail. There are also valuable sections on plant introduction, selection and breeding.

The third part provides a useful glossary of the genera and species of grasses. For each species, the distribution and adaptability are given together, where appropriate, with its agricultural value and seed rate.

This is an extremely valuable and informative book and is thoroughly recommended to all research workers, extension and advisory officers who are either directly or indirectly connected with grassland farming.

H. K. BAKER

Technical Books

308 Euston Road

London, N.W.1

(Tel: EUSton 5911)

as retail booksellers will be pleased to supply any books reviewed in this periodical, and will give immediate attention to any requirements you may have for other works

Hybrid Maize

Hybrid Maize Breeding and Seed Production by Robert W. Jugenheimer. Pp. 63. FAO, Rome, 1958. Price $4 or 20s.

The author, who is consultant of FAO on hybrid maize and Assistant Dean of the Agricultural Faculty of the University of Illinois, has succeeded in presenting a huge amount of up-to-date information in a comparatively small space. His book is a most eagerly expected and welcome aid to the scientist and the research worker.

It also contains a lot of practical information, imparted in a down-to-earth manner, for the seed producer who might not be quite conversant with some of the strictly scientific terms used by the author in chapters dealing with complex breeding problems.

The book starts with a general survey of the position of maize in world agriculture, and especially of hybrid maize. Botanical relations, inheritance and heterosis, breeding methods and evaluation are explained, with emphasis on the development of inbreds, and giving a very lucid analysis of the different breeding systems. Factors which affect maize production, such as yield, maturity, standability, heat, drought and cold resistance etc., are discussed, including special problems of breeding for livestock food, high protein, high oil content, amylose, sugar etc., and improvement of sweet corn and popcorn. Very interesting and explicit information is given about disease and insect resistance and tolerance.

One useful chapter deals with the desirable types of seed, including male sterility and pollen restorers which will ultimately reduce production costs. The breeder will find some valuable information on the development and testing of hybrids and will find a welcome short cut for his work in utilising the experience and prediction of the performance of hybrids.

The paragraph dealing with production, processing, sales and distribution is admirably practical and the description of the minimum certification standards, policy and legislation, based mainly on U.S. experience, is very helpful.

It is obvious that no reference book can be quite up to date, and so some important new developments are not included, as, for instance, reference to the new and very efficient weedkillers, simazin and atrazin, which give an almost complete answer to the weed problem.

European breeders who are working in northern areas would like to have more information about the special problems of silage and green fodder maize breeding, though this seems to be such a complex problem that it will be some time before more information is available.

It is understandable that problems in connection with certification, legis-

lation etc. are discussed based on the situation in the U.S.A., but it has to be appreciated that it is a different proposition to cater for such an enormous market as this, where size and sales possibilities make it worth while for private breeders to put in a lot of effort and funds. The economics of the limited and highly specialised European market call for more co-operation between breeders and sales organisations, and more control, and the benefits of competition are not as evident as in the U.S.A. However, these are only a few remarks from the limited European point of view.

Since Dr. Sprague's book on corn breeding—which could be called the Bible of the maize breeder—no handbook has been published containing such a complete survey of theories and procedures of breeding and of developments in maize breeding during the last 10 years.

C. DE FELLNER

Cotton Research

Report of the West African Cotton Research Conference, 18-23 November, 1957. Pp. 209. Published by the Ministry of Agriculture, Samaru, Zaria, Northern Nigeria. 1959. Price 15*s.*

This conference is one of a series held in West Africa through Anglo-French co-operation for the exchange of scientific knowledge on specific crops. It was arranged at the instigation of the West African Inter-Territorial Secretariat, Accra, and held at the Regional Research Station, Samaru, Northern Nigeria. Delegates from French, Belgian and Portuguese colonial territories and representatives from Ghana and Nigeria and officers of the Empire Cotton Growing Corporation in East Africa attended.

This was no 'armchair' conference. After the introductory proceedings delegates met in their working clothes and settled down to hard work—each day a two-hour session before breakfast, another of three hours after breakfast and a two-hour field study in the afternoon.

Each session considered a different aspect of the subject: meteorology, agronomy, plant environment, seed multiplication and distribution, breeding and selection, entomology, pathology, grading and marketing, legislation.

This report, though somewhat late in publication, is a valuable record of the event. It includes the full text of the 33 papers presented in English or French, with a summary of each in both languages. It also gives the main points of the discussions, but it should be noted that professional verbatim reporters were not employed and the exchange of views were often at a very informal conversational level.

The Minister of Agriculture, Northern Regional Government, in his opening address, reminded his audience that the prosperity of the cotton-growing industry owes much to plant breeders and other research officers, as well as to the Marketing Board system. However, it is evident from the report that the delegates were more concerned with finding solutions to present problems than recording past achievements.

D. H. GRIST

Feeding Stuffs and Grass

It is difficult to say which is the greater problem at the moment—producing the maximum amount of home-produced feeding stuffs and preparation on the farm at an economic price, or obtaining the fullest possible benefit from Britain's immense grass resources. The Electrical Development Association have produced two technical handbooks which give details of the latest techniques for meeting these problems by the use of electricity.

These books, 'Milling and Mixing' and 'Greencrop Drying', are respectively No. 6 and No. 7 in the Association's series of Farm Electrification Handbooks. They are comprehensive guides to the practical installation of suitable electrical equipment and are invaluable for advisory workers and should also prove very helpful to farmers.

'Milling and Mixing' gives much useful information on the planning and layout of complete farm food preparation equipment, mills, mixers and cubers. 'Greencrop Drying' not only shows how the weather risk can be reduced and high-quality hay produced every year, but it also deals with certain aspects of multi-purpose use of drying equipment. This book shows convincingly how high-quality feed can be produced without high-temperature drying.

Copies of these books are available from the Association at 2 Savoy Hill, London, W.C.2.

Auburn University Bulletins

Fertiliser Use and Practice by Alabama Farmers. Bulletin 320, January 1960.

Residual Value of Phosphates. Bulletin 322, January 1960.

Potassium Requirements of Crops on Alabama Soils. Bulletin 324, March 1960.

Corn Earworm Control. Bulletin 326, March 1960.

All obtainable from the Agricultural Experiment Station, Auburn University, Alabama, U.S.A., only. Prices not stated.

Common Names for Pesticides

The demand for common names for organic pest control chemicals has increased steadily with the availability of new products. Hence the timeliness of the issue of this supplement (No. 2) to B.S.1831, *Recommended Common Names for Pesticides.*

Besides listing 11 recommended common names, the supplement gives their systematic chemical names and formulae and other relevant information. The committee of experts responsible for this work hopes to publish further names before the end of 1960.

Copies may be obtained from the British Standards Institution, Sales Branch, 2 Park Street, London, W.1, price 2*s.* plus postage.

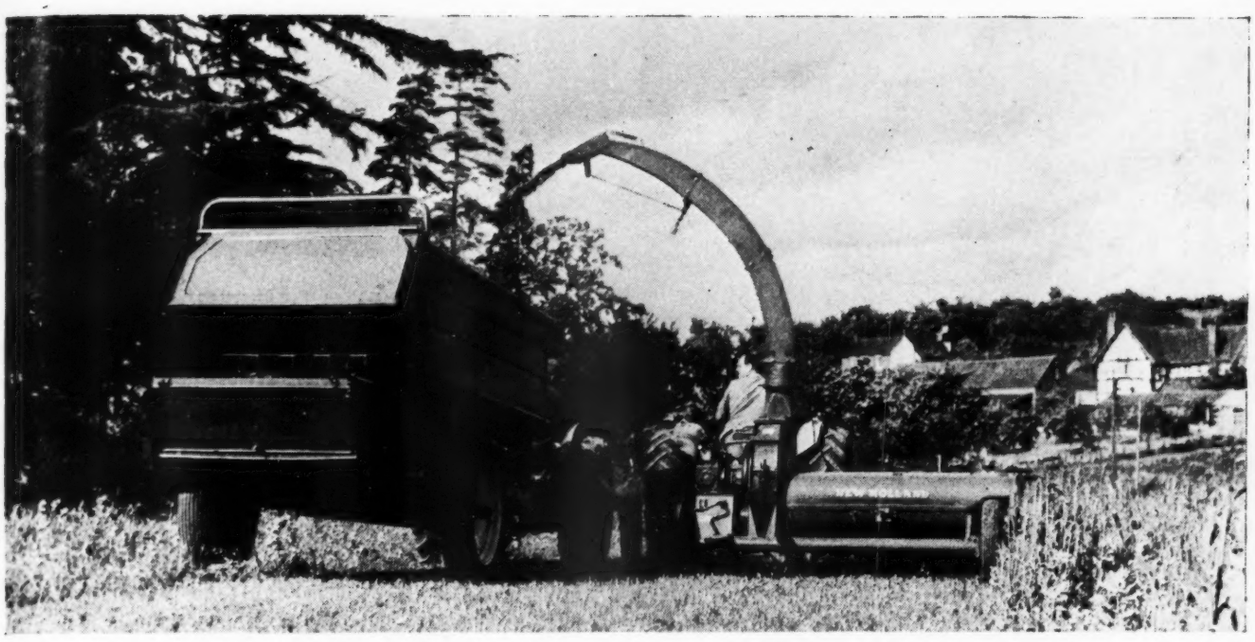
Annual Reports

East Africa High Commission. Annual Report for 1959. From the Government Printer, Nairobi, Kenya, price 5*s.*

Forestry Commission. Fortieth Annual Report of the Forestry Commissioners for the year ended 30 September 1959. Published by H.M. Stationery Office, York House, Kingsway, London, W.C.2, price 5*s.* 6*d.*

International Institute for Land Reclamation and Improvement. Annual Report for 1959. Obtainable from the Institute, Postbus 45, Wageningen, Holland. Price not stated.

Long Ashton Research Station. Annual Report of the Station for 1959. Obtainable from the Research Station, Long Ashton, Bristol. Price not stated.



The Model 33 crop chopper delivering chopped forage into the Model 330 self-unloading forage box

Machinery and Equipment

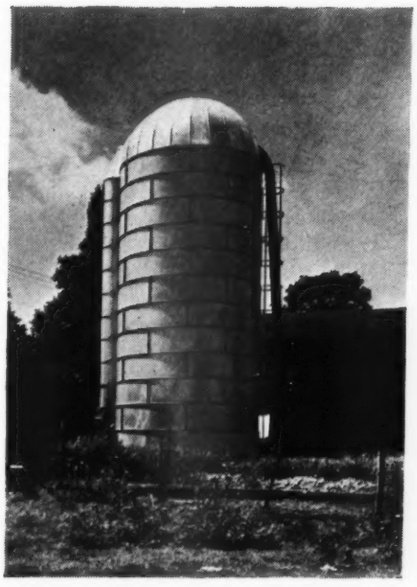
Silage Harvesting

A complete system for chopping, transporting and blowing silage into the silo was recently introduced by the *New Holland Machine Co. Ltd.*

Their Model 33 is a double-chop harvester in which the length of chop can be varied according to the number of knives fitted to the rotor. Normally 32 curved knives are used to cut a 5-ft. swath and lift the material into a 12-in. chain-driven auger which feeds it into a 'Curvo-Thrust' cutter head to chop it finer. A torrent of fresh green feed is blown up a chute with a delivery head, which is adjustable from the driving seat, to ensure its even distribution in the accompanying 330-bushel forage box, which is drawn by another tractor.

The transporter is a dual-purpose machine, with a moving floor, which can be used either as a manure spreader or as a self-unloading forage box. Used as a manure spreader, it can carry 130 bushels and as a forage box it can carry 3½ tons of chopped material.

This amount of feed can be unloaded in five minutes and delivered by means of their Model 22 forage blower to the top of a tower silo. This machine can deliver 42 tons per hour.



The Braby tower silo on a farm in Surrey

Tower Silo for Silage

Ensilage is the process by which a farmer can preserve the maximum food value of a green crop to feed his animals during the cold winter months or in the dry months when grass will not grow or, if it does, it is of low food value.

The method of storage of the cut green feed is important. If the material is stored in a pit or clamp, there is always some loss, for up to 30% of the outer 12-36 in. of all exposed surfaces is wasted.

By ensiling the crop in a closed cylinder only the top surface is exposed and the cavity over the cut silage is soon filled with carbon dioxide, thereby reducing the wastage.

A steel silo, 15 ft. dia. by 30 ft. high, with a capacity of about 120 tons, as illustrated, is offered by *Frederick Braby & Co. Ltd.*

More Spin, Less Work

When a tractor and its following trailer or implement are operating over soft ground or in boggy conditions, wheel spin can be most exasperating and time-consuming; fuel is wasted and tyres are rapidly worn away. Frequently work may be stopped while the unit is being extricated from the hole in which the machine has buried itself.

One way of reducing wheel spin is by fitting cage wheels, another is by permanently attaching heavy and expensive wheel weights—the latest method is to transfer a part of the

A Massey-Ferguson '65', fitted with the 'Multipull' hitch, being driven uphill without wheelspin over very soft loam at the Stoneleigh Abbey School of Mechanisation.

weight of the trailer or implement to the rear wheels of the tractor by means of a simple device called the 'Multi-pull Hitch'.

This device consists of a rectangular iron frame which is attached to the three-point linkage and carries three chains. One pair is connected to the pick-up hitch for stabilising the device; the third chain passes loosely under the towbar and is carried by a pulley which is free to move laterally along the top of the iron frame to allow for changes in direction.

It is this third loose chain which provides the transfer of weight, for when lifting power is applied hydraulically through the top link the chain tightens and in effect attempts to lift the following implement. In so doing, a part of its weight is transferred through the top link to the driving wheels, which at once cease to spin, so that forward progress is resumed.

It is recommended that a weight-frame should be fitted to the front of the tractor to take up to eight 60-lb. weights, each of which can be quickly removed by undoing a securing nut. This will actually result in a transfer of up to 1,000 lb. to the rear wheels, which visibly show the added pressure when tension is applied through the hydraulic linkage.

In effect, the tractor and implement then together constitute a lever and the rear wheels, which are the fulcrum, take the part weight of the implement and the counter-balancing weights in front. It is this combined weight which ensures better adhesion and wheel grip.

The new hitch was originally developed and patented for use with implements, such as the gang roller or heavy harrow, by *Massey-Ferguson's* Swedish distributors, *Aktiebolaget Farming*, and already more than a thousand are in use in Scandinavia. It was recently used by our representative at the Stoneleigh Abbey School of Mechanisation and its effectiveness convincingly demonstrated.

The rear of the tractor with the 'Multi-pull' hitch attached and showing the loose chain carried on the free-running pulley

Left:

The front of the tractor showing the method of adding the weights

Crop Sprayers for Pakistan

A large order for various types of crop-spraying machines has been received from the Pakistan Government by *Micron Sprayers Ltd.*, of the *Birfield Group*.

The first shipment consists of 150 shoulder-mounted and four trolley-mounted 'Micronette' machines. These are being followed by a further shipment to Karachi of 50 shoulder-mounted and 20 trolley-mounted 'Micronettes'. The balance of this large order, comprising 300 'Micronettes', 10 'Micron Megs' and nine sets of 'Micronair' equipment, is all to be sent later.

These machines produce the extremely fine and even droplet size that is required for low-volume crop spraying. They are to be used for the control of pests on a variety of crops, which include rice, jute, sugar-cane, cotton, oil seed, mango, citrus fruit and tea.

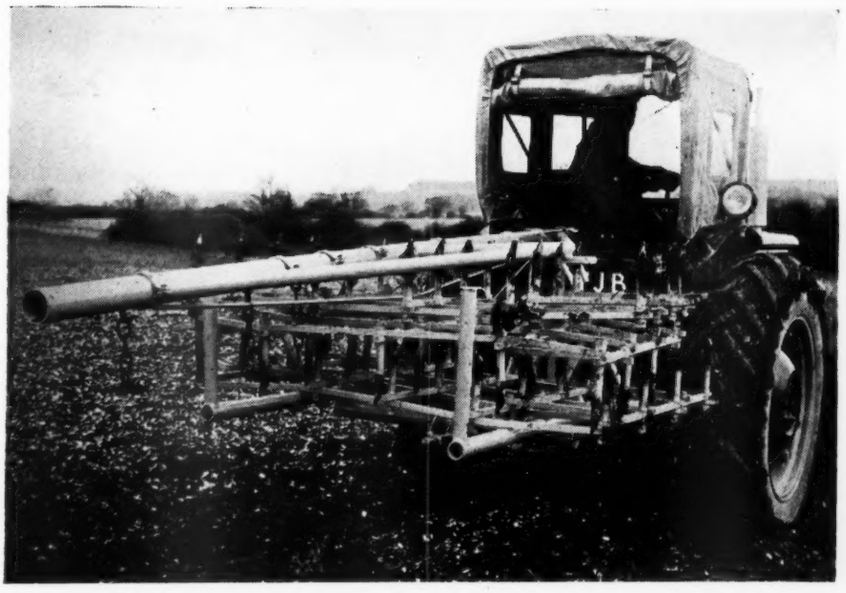
Rugged Performance

The new *Cameron Gardner* hedgecutter is designed for mid-mounting on *Fordson* Power Major and Major tractors. It is made up of a tubular lifting boom, which may be raised or lowered by a hydraulic ram, and a cutting blade assembly, which is driven by V-belts driving a set of right-angle gears at the cutter end.

There are two types of cutting blades. The slashing blade is a near-circular blade with four 2-in. deep cutting notches; the other is a conventional circular saw; both are 36 in. in dia., but the slasher is $\frac{1}{4}$ in. thick, whilst the latter is $\frac{3}{16}$ in. thick. The blade rotates at 1,500 r.p.m. at an engine speed of 1,400 r.p.m. The cutter assembly can be adjusted to cut at a wide range of angles.

The machine is offered for rugged, heavy-duty performance and it has the strength to meet reasonable abuse from hidden obstructions. The easily sharpened slashing blade will cut growth up to 4 in. in dia. and the circular saw will deal with growths larger than this. The tractor and hedgecutter combination can be operated by one man without difficulty; the mid-mounting gives the driver full vision, so that tight corners and confined spaces can easily be worked.

The V-belt drive is well guarded, the tubular boom is of sturdy construction, and special attention has been given to the strength and security of the rotating blade. The driver is protected against flying timber if a tractor cab is also fitted.



A tractor fitted with a Lambourn canvas cab and the new rear-mounted 'Harrow-Barrow' and carrying two spike harrows and the tubular towing pole

Reader Service

For further information on any item reviewed in this issue please use the card provided or write to:

Reader Service,
World Crops,
Leonard Hill House,
Eden Street, London, N.W.1,
England

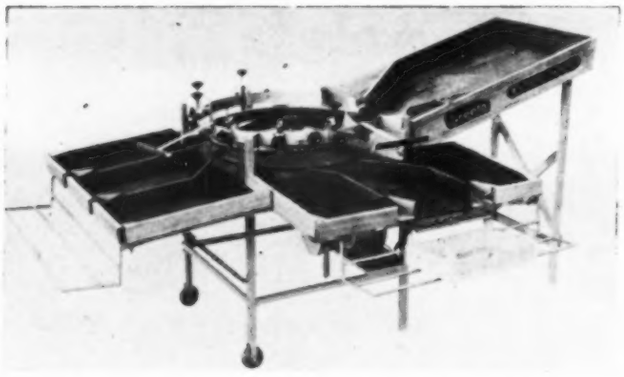
The new Cameron Gardner hedgecutter is designed for rugged heavy-duty performance

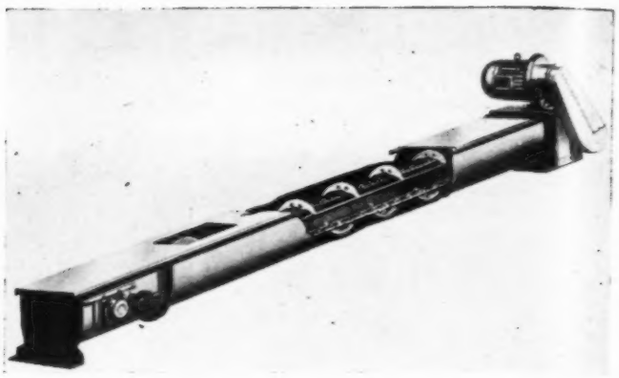
A Harrow Barrow

An extra man and a trailer are normally required when a spike harrow has to be transported from the farm to the scene of operations, from field to field, and back to the farm.

With a tractor fitment called the 'Harrow-Barrow' these operations can be carried out single-handed and a trailer is not required. This implement, which is manufactured by *Lambourn Garages and Engineering Works*, is a carrier which is mounted on the 3-point attachment of the tractor; there is also a towing bar for attachment to the drawbar of the tractor, so that two harrows can be drawn behind by means of eight adjustable clips fitted with chain linkage.

The carrier consists of two manually-telescopic arms on to which the two harrows are loaded for transportation. These arms can be revolved so that two extensions at right angles can be used as retainers to keep the harrows on the carrier when travelling fast along rough farm roads.





Left: *The 'Greefa' tomato grader is powered by a ¼-h.p. motor.* Right: *The 'Super-Flo' conveyor with a section removed to show the plastic flights, mounted on the moving chain*

Grading Fruit for Size

The 'Greefa' grader, recently introduced by *W. Weeks & Son Ltd.*, is primarily designed for grading tomatoes for size, but it would be equally suitable for apples, pears, oranges and grapefruits. In all, six basic sizes are obtainable, with a seventh for undersized small fruits.

The machine consists basically of a revolving disk on the circumference of which are a series of rubber sizing bars, adjustable to whatever diameters are required. When a fruit reaches a sizing bar where the gap is sufficient for it to pass, it is delivered into the corresponding packing tray.

For Conveying Granular Materials

The 'Super-Flo' conveyor, manufactured by *W. S. Barron & Son Ltd.*, consists of a series of plastic flights, which are carried on a moving chain inside a conveyor trough which can be arranged horizontally or at an angle. The makers claim that it will give the least possible breakdown of the material and is clean in operation. Operating costs are low and it is easy to maintain.

It is being specially recommended for conveying powdered or granular materials, such as flour, coffee, sugar, salt, fertilisers, feeding grains, cubes, pellets and similar materials.

Mowing Made Easy

An interesting new development by *Hayters Ltd.* is the offer of a robust 30-in. 5-bladed cylinder for attachment to their self-propelled 26-in. rotary scythe. The new 30-in. cylinder revolves at constant speed, but with choice of forward speeds: 1½ m.p.h. in first gear; 3 m.p.h. in second, and 4¼ m.p.h. in third. The constant speed of the cylinder revolutions gives a good finish in second gear, with correspondingly finer or coarser cutting in first or third gears.

The 26-in. *Hayter rotary scythe fitted with the* 30-*in. mower attachment in front and a roller-seat attachment in the rear*

Grain Handling

The 'Scattergrain' is a simple device for ensuring the even distribution of grain in silos and the elimination of damp patches by spreading the material. It does not require any external source of power, as it is operated by the weight of the falling grain, which as it falls down from the elevator or screw conveyor causes the spinner to revolve at a fairly high speed, so that the grain is well mixed and spread over a wide area without any further manhandling being necessary. The unit, which is being manufactured by *Opancol Ltd.*, is easy to install and can be carried by one man.

Seed Cleaning and Grading

The *Superior Separator Co.*, of U.S.A., are manufacturers of grain-cleaning and seed-grading machines, and the U.K. distributors are *R. W. Gunson (Seeds) Ltd.* The model S-4 is a grader for hybrid seed maize; it is a sieve machine arranged in series to grade the seed by width, thickness and a combination of both. The C-33 machine is a length grader for rice, barley, wheat, oats etc.; it can be used alone or superimposed one unit above the other. It can either be used for precision grading or for the re-treatment of 'rejects' and has a capacity of from 75-100 bushels per hour.

The FA-48 is a fractionating aspirator specially designed for cleaning coffee and separating it into premium, first and second grades at a rate of 30-40 cwt. per hour. The very latest model is the CC-8, an 8-cylinder machine for the high-speed cleaning and separation of all types of grain and with a capacity of 500-600 bushels per hour for rice, from which it will produce seven separate end-products.

Correction

ROGOR 40

In the article entitled 'Control of Citrus Pests in Cyprus', which appeared in our October issue, the title over Table 1 on page 391 is incorrect. It should have read 'Control of Citrus Red Scale'.

Agricultural Chemicals and Supplies

Wheat Bulb Fly

This pest can cause serious damage to late-sown winter wheat and early-sown spring wheat. The flies lay their eggs in the soil in July or August; these hatch out in late January or February and the larvae then bore into the germinating seed.

A new product, 'Granadin W', offered by *British Scheering Ltd.*, used as a seed dressing, will protect the seed without affecting subsequent germination or later growth and, according to the manufacturers, a single treatment will not only control wheat bulb fly, but also wireworm and seed-borne diseases.

Apples with Two Skins

Out of every 500 apples harvested, only about seven are selected for the production of 'exhibition-quality fruit' by *Entwistle & Bacon Ltd.*, producers of the Spring Valley brand of apples.

The selected fruit—each of perfect shape, size, colour and condition—are separately wrapped in an attractive second skin of transparent semi-permeable 'Pliofilm', which is made by the *Goodyear Tyre & Rubber Co. Ltd.* With this protective covering the apple continues to develop its flavour and bouquet.

Normally an apple exposed to the air starts to deteriorate and as it matures it liberates carbon dioxide, which must be carried away or the flesh of the apple will break down. The function of the second skin is to allow this gas to escape and still keep away the outside air.

The appearance of the fruit is enenhanced by the shiny covering, which is not removed until they are eaten.

Polythene Coating

The multi-wall 'Palfsacks', manufactured by *William Palfrey Ltd.*, can now be obtained with an inside ply of polythene-coated paper.

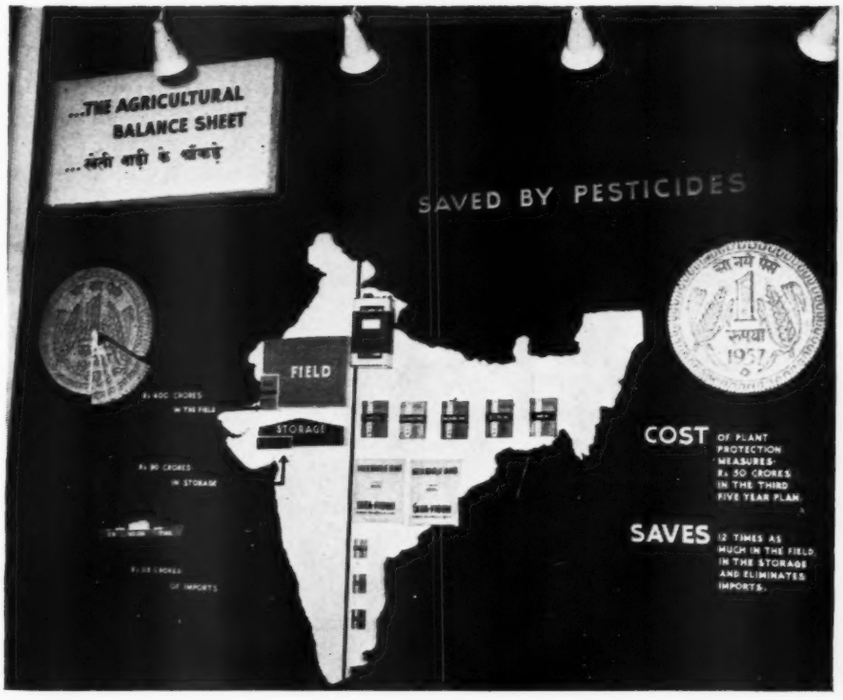
The polythene coating is tasteless, odourless and non-toxic and its density is such that it prevents the permeation of moisture and vapour. The new 'Palfsack' is thus a suitable container for all hygroscopic chemicals and fertilisers and the coated ply also prevents oxidation of the contents.

In one test in Ghana 'Palfsacks' of this type were used for the storage of edible fish meal for a period of 13 months. On opening the sacks the contents were found to be practically indistinguishable from freshly prepared meal, with no significant rise in the moisture content.

Potato Haulm Killer

It has been customary for potato growers to burn off potato haulm once there was sufficient weight of crop. This practice stops growth, destroys blight spores and allows easier mechanical harvesting. Potatoes which are lifted with blight spores still alive can suffer 50% loss in the clamp later on.

After the withdrawal by chemical manufacturers in the U.K. of the highly poisonous sodium-potassium arsenite, a replacement was needed which would be safe, non-poisonous and economical. *J. D. Campbell & Sons Ltd.* are now offering a new chemical—'Dee Foliet NU'—which they claim will supply this need. The new chemical, according to the growers who tested it in various parts of the country, has proved highly effective as a potato haulm destroyer.


...THE AGRICULTURAL BALANCE SHEET
SAVED BY PESTICIDES
FIELD
STORAGE
COST OF PLANT PROTECTION MEASURES- Rs 50 CRORES IN THE THIRD FIVE YEAR PLAN.
SAVES 12 TIMES AS MUCH IN THE FIELD, IN THE STORAGE AND ELIMINATES IMPORTS.

Chemicals at World Fair

Part of the display on the Tata-Fison stand at the World Agriculture Fair held in India earlier this year is shown above. This illustrated diagrammatically how *Tata-Fison* has helped Indian farmers; other parts of the stand displayed aspects of the research work behind the production of agricultural chemicals and demonstrated the importance of chemicals in plant protection and public health.

The World Agriculture Fair, in which 12 countries participated, was organised by the Farmers' Forum of India and lasted for two and a half months.

Chemical Nomenclature—2. Weedkillers

Continuing the nomenclature of chemicals used in crop protection, this is a list of chemical trivial and trade names for some common weedkillers. In the next issue there will be a similar list of organic fungicides and soil fumigants.

Chemical Group and Name	*Trivial Name Proposed or Accepted*	*Trade Marks of Some Formulations in Common Use*
4-chloro-2-methylphenoxyacetic acid	MCPA	
2,4-dichlorophenoxyacetic acid	2,4-D	
2,4,5-trichlorophenoxyacetic acid	2,4,5-T	
4-(4-chloro-2-methylphenoxy) butyric acid	MCPB	
4-(2,4-dichlorophenoxy) butyric acid	2,4-DB	
2-(2,4,5-trichlorophenoxy) propionic acid	2,4,5-TP	'Silvex'
2-(4-chloro-2-methylphenoxy) propionic acid	mecoprop CMPP	
2,3,6-trichlorobenzoic acid	TBA	
2-chloro-4,6-bis ethylamino-1,3,5-triazine	simazine	
2-chloro-4 isopropylamino-6-ethylamino-1,3,5-triazine	(atrazine)	
2-methoxy-4,6-bis (isopropylamino) 1,3,5-triazine	(prometone)	
2-methoxy-4-ethylamino-6-isopropylamino-1,3,5-triazine	(atratone)	
2-chloro-4-diethylamino 6-ethylamino-1,3,5-triazine	trietazine	
2-chloro-4,6-bis (isopropylamino)-1,3,5-triazine	(propazine)	
N-(3,4-dichlorophenyl)-N′N′-dimethylurea	diuron	'Telvar'
N-p-chlorophenyl-N′N′-dimethylurea	monuron CMU	'Karmex'
ethyl-N,N-di-n-propylthiolcarbamate	EPTC eptam diprobam-ethyl	
4-chloro-2-butynyl N-(3-chlorophenyl) carbamate	(barban)	'Carbyne'
2,3-dichlorallyl N,N-di-isopropylthiol-carbamate		'Avadex'
isopropyl N-phenylcarbamate	propham IPC	
isopropyl N-3-chlorophenylcarbamate	chlorpropham CIPC	
2,2-dichloropropionic acid	dalapon	
trichloroacetic acid	TCA	
2-(2,4,5-trichlorophenoxy) ethyl-2,2-dichloropropionate	(erbon)	
1,1′-ethylene-2,2′-dipyridylium dibromide monohydrate	diquat	'Reglone'
disodium-3,6-endoxohexahydrophthalate		'Endothal'
3-amino-1,2,4-triazole	amitrol ATA	'Weedazol'
N-1-naphthylphthalamic acid	NPA naptalam	'Analap'
N,N-diallyl 2-chloroacetamide	CDAA	'Randox'
2-methyl-4,6-dinitrophenol	DNC DNOC	
2-sec-butyl-4,6-dinitrophenol	dinoseb DNBP	
pentachlorophenol	PCP	

World Crop Reports

Larger Citrus Crop Forecast

INTERNATIONAL REPORT

Citrus fruits

Nearly every citrus area is continuing to expand plantings. Potential world production in 1960 is substantially above present levels, but disease, frost and marketing difficulties will probably prevent the full potential from being realised.

The 1959-60 orange crop from the bloom of 1959 was the largest on record, while total grapefruit and lemon production was smaller than in the previous year.

Oranges: crops in North America were smaller than the previous year due to a temporary decrease in U.S. production. Mediterranean production increased by over 15 million boxes. Southern Hemisphere crops also increased due to South Africa's record harvest.

Grapefruit: a smaller crop in the U.S.A. has lowered world production. Plantings are being extended in both the U.S.A. and Israel.

Lemons: smaller crops in Italy and Argentina more than offset larger output in the U.S.A. and Chile. Lemons are likely to be in surplus supply as new plantings come into production.

Hops

Revised estimates of the world's production of hops in 1959-60 show a decline of 1.4 million lb. from the record 1958-59 crop.

Large increases in the U.S.A. and Yugoslavia and moderate increases in West Germany, Japan, France and some other countries were more than offset by declines in the U.K., Australia, Czechoslovakia, Belgium and New Zealand. Production rose over 5 million lb. in the U.S.A. and over 3 million in Yugoslavia, but declined nearly 9 million lb. in the U.K., nearly 1.8 million in Czechoslovakia and about 1 million in Australia. Of the 1959 U.S. crop of 53 million lb., 1.4 million were not harvested because of market conditions.

In the *U.S.A.* an increase in yield from 1,449 lb. per acre in 1958 to 1,619 lb. in 1959 greatly offset the small decline in hops acreage—from 33,400 to 33,100 acres. In *France* also an increase in yield offset an acreage reduction. But the larger production in *Yugoslavia*, *Japan* and *West Germany* was due largely to expansion in producing area.

Gathering oranges on the Rembander Native Trust Farm in the Northern Transvaal. South Africa had a record harvest of oranges this year

The sharp decline in the *U.K.* was mainly the result of a cold 1958-59 winter, followed by an unusually hot, dry summer. *Australia's* 1959-60 outturn was seriously reduced by hail and flood damage and by lack of winter rains in some parts of Tasmania, which produces over 80% of the crop.

New Zealand reduced its hops acreage because of excess production last year. In *Belgium* the effects of the 1959 drought more than offset an increase in the producing area. Other countries which reduced their hops acreage were *Sweden* and the U.K. Those in which the area increased include *Argentina*, *Austria*, *Canada*, *Mexico*, *Spain* and *Switzerland*. Argentina, Austria, France, West Germany, Japan, the *Union of South Africa* and the U.S.A. are among the countries in which growing conditions were generally favourable. In the countries for which information is available the quality of the 1959-60 crop was from fair to excellent.

Since hops production depends so much upon growing and harvesting conditions, the size of the 1960-61 world crop is still very difficult to predict. Additional expansion of area is expected in Yugoslavia and some of the smaller producing countries, including Argentina, Spain and Switzerland. On the other hand, the U.S. area will be over 3,000 acres below the 1959 level. Hops area may also be reduced in West Germany.

Severe flood damage in Tasmania may further reduce Australia's production by about 700,000 lb. In nearly all countries for which information is available beer production and hops consumption are generally increasing. The gradual downward trend in U.S. hops consumption is being reversed during 1959-60. Countries in which hops usage is showing little change or is declining include Australia, Belgium, Denmark, New Zealand and the Union of South Africa.

Ramie

The 1959 production of ramie fibre is estimated at about 35 million lb., compared with approximately 28 million in 1958. The largest increase was in *Brazil*, the world's leading producer.

Ramie (China grass or grass linen) is a soft fibre of considerable strength and lustre, used in the manufacture of upholstery, drapery, household fabrics, clothing, trimmings and various other goods. It has hitherto been grown only in small quantities. The principal hindrance to its more extensive production is the difficulty in perfecting machinery to prepare a good grade of fibre at prices competitive with other fibres.

China was the principal source of earlier supplies and the Philippines furnished a large percentage during World War II. Growing interest in the fibre in recent years led to increased study of mechanical processing and experimental cultivation in many countries. U.S. production reached several million lb. in 1954, but declined later.

China

This year was the worst year for agriculture for many decades, according to the *Chinese People's Daily*. It is reported that over 100 million acres have been affected by intense drought and typhoons. The flow of the Yellow River was reduced to one third and a typhoon which struck Kwangtung and Fukien provinces early in June caused floods of unprecedented seriousness, according to the report.

It is, however, suggested by the London *Daily Telegraph* that this report may be an exaggeration to explain why agricultural production for the second year may not come up to target expectations—see WORLD CROPS, **11**, 1959, 452.

Mali

Mali, which became fully independent in June 1960, is one of the world's largest exporters of *groundnuts*. In some recent years it has been the largest; in others it has been second to Nigeria. It also exports flour, hides and skins, and other agricultural products.

Mali is a federation of Senegal and Soudan, two of the eight territories which made up the former federation of French West Africa. It extends from the Atlantic Ocean at Dakar far into the Sahara.

In 1959 Mali exported 317,000 short tons of shelled groundnuts, 109,000 short tons of raw groundnut oil, 16,500 short tons of refined groundnut oil and 169,000 short tons of groundnut oil cake. In all, exports of groundnuts and groundnut products made up 87% of all exports, agricultural and non-agricultural.

Agricultural exports also included 4,700 short tons of gum arabic, 13,300 short tons of wheat flour, 2,500 short tons of hides and skins and 3,300 short tons of palm kernels.

U.S.S.R.

The U.S.S.R. reports that the total area sown to crops during 1960 is 16.3 million acres larger than last year. Sown acreage in 1960 is reported in *Izvestia* as 501.4 million acres, which is 3.4% greater than the 485.1 million acres reported for 1959.

Spring crops account for 86% of the increase. The Soviets report that they have sown 14.1 million more acres of spring crops this year than last. This does not include another 19.8 million acres of winter-killed crops which were replanted this spring. The total area in spring crops is listed as 378.1 million acres, with 93% (350.9 million) on collective and State farms.

Area sown to spring *wheat* this year is reported to be 8.2 million acres larger than 1959 acreage. This increase, however, is somewhat offset by a decline in winter wheat, which had to be resown to spring wheat or *maize* as a result of damage by unfavourable weather during the winter and early spring. Maize for grain, silage and green feed has been expanded by 14.1 million acres over 1959. *Millet* and *buckwheat* acreage is up from 1959 by almost 4 million acres, *legumes* 1.2 million acres, *sunflowers* 890,000 acres, *sugar-beets* 815,000 acres and *cotton* 49,000 acres. *Flax* and *vegetable* plantings are also said to be larger than last year.

France

France is harvesting smaller grain crops than in 1959, according to preliminary forecasts.

Wheat production is expected to be about 390 million bushels, but may reach 405 million, if harvesting conditions are favourable. Both acreage and yields are less than in 1959, when there was a large harvest of 425 million bushels.

In addition to lower wheat acreage, the acreage of *rye*, *oats* and *mixed grains* is smaller; acreage of *barley* and *maize* is larger. The area seeded to barley is the second largest on record and a crop of about 230 million bushels is forecast. This is slightly above the 226 million bushels harvested last year.

The trend to plant barley instead of oats continues, and oats acreage is at its lowest. The harvest is expected to be about 180 million bushels, well below the 226 million bushels reported last year.

Production of *flax fibre* in 1959 continued downward in France, a country whose production is exceeded only by the U.S.S.R. and Poland.

Fibre from the 1959 harvest is estimated at 45.4 million lb., compared with 46.2 million in 1958 and the 1954-58 average of 74.4 million. Areas planted to flax in the corresponding periods were reported officially at 74,300 acres in 1959, 98,800 in 1958, and 121,800 in 1954-58.

England and Wales

The weather during August continued changeable with frequent thunderstorms and variable rainfall, which was heavy and prolonged in places.

In some areas, particularly where combining had been possible, considerable progress had been made with the harvesting of *cereal crops*, but in many other areas harvesting had been retarded by heavy rain and storm damage, lodging being rather widespread.

Wheat generally was standing well, although some crops were badly laid. 'Take-all' was prevalent in a few districts. The quality of *barley* was variable, but the general condition was satisfactory.

There was no serious deterioration of unharvested crops, although lodging was reported from many areas, and in some cases undersown seeds were growing through.

A considerable proportion of the *oat* crop in the southern half of the country had been harvested or was in stook; in northern districts some crops were ripening slowly. On the whole, the quality of the grain was variable, but their general condition was fairly satisfactory. Sprouting was reported from several areas and many uncut crops were lodged. *Mixed corn* on the whole was in fairly good condition. Lodging had occurred among unharvested crops.

Maincrop *potato* varieties made good growth during the month. Blight was universal and in some districts tubers were affected; the haulm of many crops had been burnt off.

Sugar-beet had made good growth and crops were promising. Virus yellows, although not severe, were becoming widespread in many areas. The yield per acre of roots was expected to be above average. *Mangolds* were very promising and the yield per acre was expected to be above average. *Turnips and swedes* made good growth; the yield per acre was expected to be above average. *Kale* on the whole was growing very well, although weeds were retarding some later sown crops.

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